BULLETS. AMMUNITION. RELOADING. SECURITY.

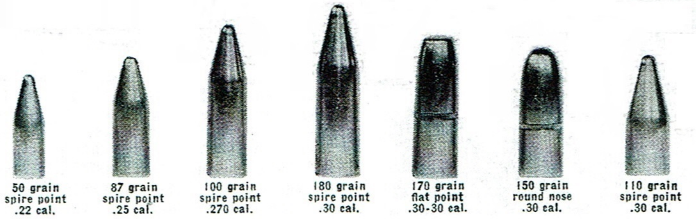
Hornady®

AMERICAN MADE AMERICAN OWNED FOR 75 YEARS

Hornady
Accurate. Deadly. Dependable.
Hornady
Hornady
25
Hornady
CRITICAL DEFENSE
LOADED WITH PATENTED FTX® BULLET

THE JOYCE HORNADY LEGACY

Joyce Hornady
1907-1981


50 grain spire point .22 cal.
87 grain spire point .25 cal.
100 grain spire point .270 cal.
180 grain spire point .30 cal.
170 grain flat point .30-30 cal.
150 grain round nose .30 cal.
110 grain spire point .30 cal.

1949 - 2024

CELEBRATING 75 YEARS

THANK YOU

The man that started it all, Joyce Hornady was an avid hunter. His love of the sport helped fuel his lifelong mission to create accurate, deadly, and dependable bullets.

In the last 75 years, we've come a long way. Not only have we grown from a four-man operation in an old auto garage in 1949 into a thriving international business, but we've pushed our industry forward with groundbreaking innovations. Long before Hornady Manufacturing made their first bullet, the spirit of innovation was alive in my dad (Jason's grandfather). The problem was simple: commercially available bullets were not accurate enough for the demanding shooter. The solution, however, was not so easy. With determination and a goal, the company was founded – aiming to produce a bullet that was accurate, deadly, and dependable.

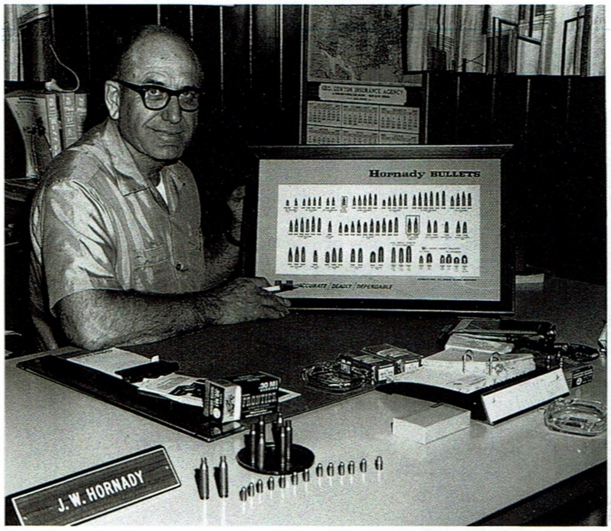
The fire for product innovation still burns inside our company, just as it did 75 years ago. The team we've assembled of operators, engineers, and ballisticians are passionate users of our products. Being actively engaged in the shooting and hunting community ensures we continue to develop new products that resonate with hunters and shooters all over the world. Producing high volumes of high-quality products is no easy task but one we take seriously. To go along with our growing manufacturing capabilities, we've also dedicated considerable resources into world-class product distribution.

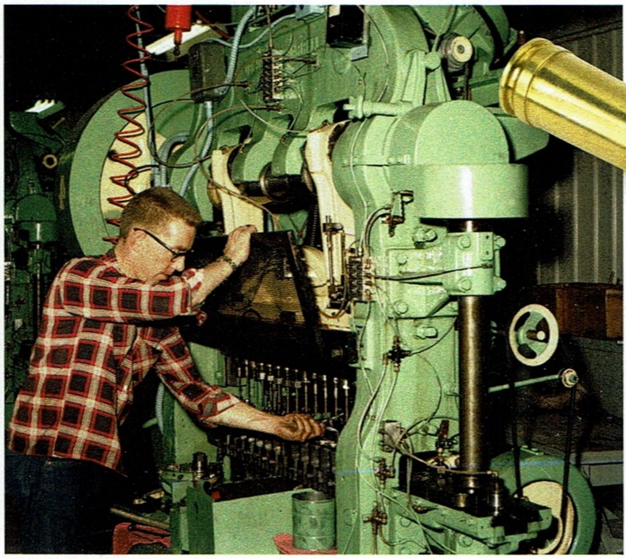
What would our 75th anniversary look like without you, our customers? We enjoy receiving your letters, emails, and social media tags. You may be surprised how many product developments were spurred from simply listening to what our customers demand. Without the support from the shooting community, Hornady as we know it would not be the same; and for that, we thank you.

It is amazing to look around our company today and reflect on our humble beginnings. What started as one man's dream of a more accurate bullet has turned into a product line of bullets, ammo, reloading tools, and security products that are trusted all over the world. While we are celebrating the last three-quarters of a century, we are also looking forward. Our pledge to you is that we will continue to innovate, produce and ship products, and listen to what our customers' needs are. Here's to the next 75 years!

Steve Hornady

Hornady®





1 **Letter**
By Jason Hornady

4 **75 Years of Hornady**
Accurate, deadly, dependable bullets … and much more.
By Craig Boddington

12 **Accurate. Deadly. Dependable.**
How Hornady bullet introductions shaped the future.
By Joseph von Benedikt

18 **Hornady: From Startup to Innovative Bullet Designs**
Understandably, it's easy to overlook (or care about) history when sending a bullet downrange. But, it's almost certain that Joyce Hornady and his company influenced that bullet's design. Here's your history lesson.
By Aaron Carter

24 **Reviving Lever Guns**
Hornady's pointed FTX bullets bring new life to classic cartridges.
By Joseph von Benedikt

30 **6.5 Creedmoor Success**
Winning the hearts and minds of shooters everywhere is no small feat.
By Dave Emary

36 **New Cartridge Introductions**
Let the record show that Hornady has introduced the best precision hunting cartridges of all time.
By Joseph von Benedikt

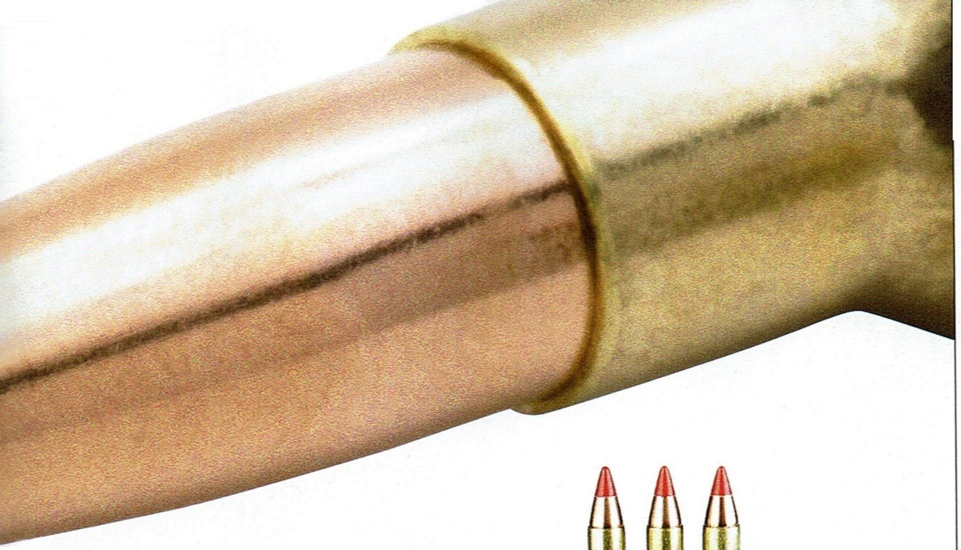
42 **What's in a Name?**
The story of Hornady's Frontier brand of ammunition.
By Dave Emary

48 **Safe and Secure**
There's more to Hornady than premium-grade ammunition.
By Richard Nance

54 **Cutting Edge**
Doppler radar and the science and development behind the ELD-X and ELD Match bullets.
By Dave Emary

62 **Hornady's Magnum Rimfire**
Reflecting on 20 years and one billion rounds of .17 HMR.
By Craig Boddington

68 **Paving the Way**
Here's the story of Hornady's acquisition of Pacific Tool and Western Gun and Supply.
By Colton Heward



17 GR. V-MAX
Read all warnings before use.
Hornady
17
HMR
17 GR. V-MAX™

74 **Hornady DGX Bonded**
Big-bore bullet technology for the most dangerous game.
By Eric R. Poole

80 **Three Generations (and Counting) of Bullet Making**
A conversation with the Hornadys.
By Joe Arterburn

86 **Carrying the Torch**
The Flex Tip story.
By Dave Emary

92 **4DOF Ballistic Calculator**
Hornady packs state-of-the-art ballistic solutions into a free app.
By Alfredo Rico

94 **Mission Critical**
Whether for defense or duty, Hornady has you covered.
By Richard Nance

98 **Smoke Stacked**
From round balls to Bore Driver, Hornady's muzzleloader bullet development has kept pace with advancements in blackpowder rifle technology.
By Brad Fitzpatrick

102 **Beauty is More Than Skin Deep**
Long-range shooting is the new frontier of riflery. Hornady promises to make it a lot easier to hit past 1,000 yards.
By Tom Beckstrand

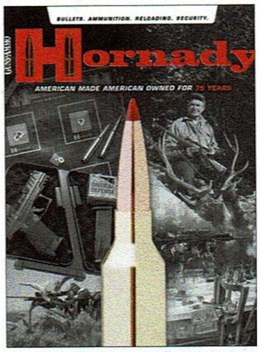
GUNS&AMMO

VP Shooting Group Publisher
Chris Agnes

EDITORIAL
Editor **D. Faubion**
Managing Editor **Jayce Kadoun**
Digital Editor, Hunting **Drew Pellman**

ART
Art Director **Erik Siembab**
Senior Designer **Luu Mai**
Designer **Aaron Berger**
Staff Photographer **Michael Anschuetz**

PRODUCTION
Sr. Director, Production **Connie Mendoza**
Anthony Smyth (914) 409-4202


BULLETS. AMMUNITION. RELOADING. SECURITY.
Hornady
AMERICAN MADE AMERICAN OWNED FOR 75 YEARS

OUTDOOR SPORTSMAN GROUP®
PUBLISHING & BRANDED MEDIA

Chief Operating Officer, Publishing & Branded Media **Mike Carney**
EVP, Group Publisher & Operations **Derek Sevcik**
VP, Consumer Marketing **Peter Watt**
VP, Manufacturing **Deb Daniels**
Senior Director, Production **Connie Mendoza**
Director, Publishing Technology **Kyle Morgan**
Senior Creative Director **Tim Neher**
Director, Digital Editorial **Darren Choate**

OUTDOOR SPORTSMAN GROUP® NETWORKS
outdoorsg.com

TELEVISION
outdoorchannel.com
thesportsmanchannel.com
worldfishingnetwork.com

HUNTING
bowhunter.com
bowhuntingmag.com
gundogmag.com
petersenshunting.com
northamericanwhitetail.com
wildfowlmag.com

FISHING
bassfan.com
floridasportsman.com
flyfisherman.com
gameandfishmag.com
in-fisherman.com

SHOOTING
gunsandammo.com
handguns.com
rifleshootermag.com
shootingtimes.com
firearmsnews.com

Copyright 2023 By Outdoor Sportsman Group®
All Rights Reserved. No part of this book may be reproduced without written permission.

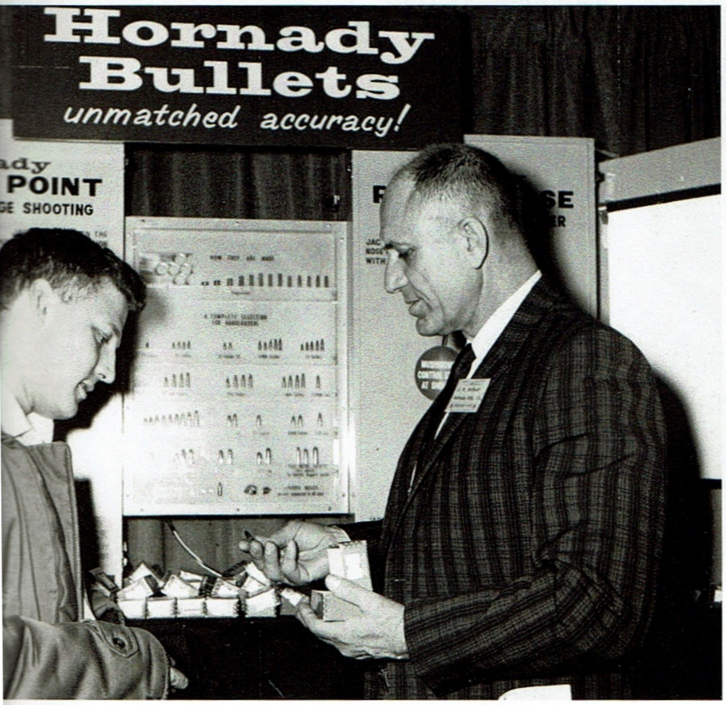
1040 6th Ave., 17th Floor
New York, NY 10018

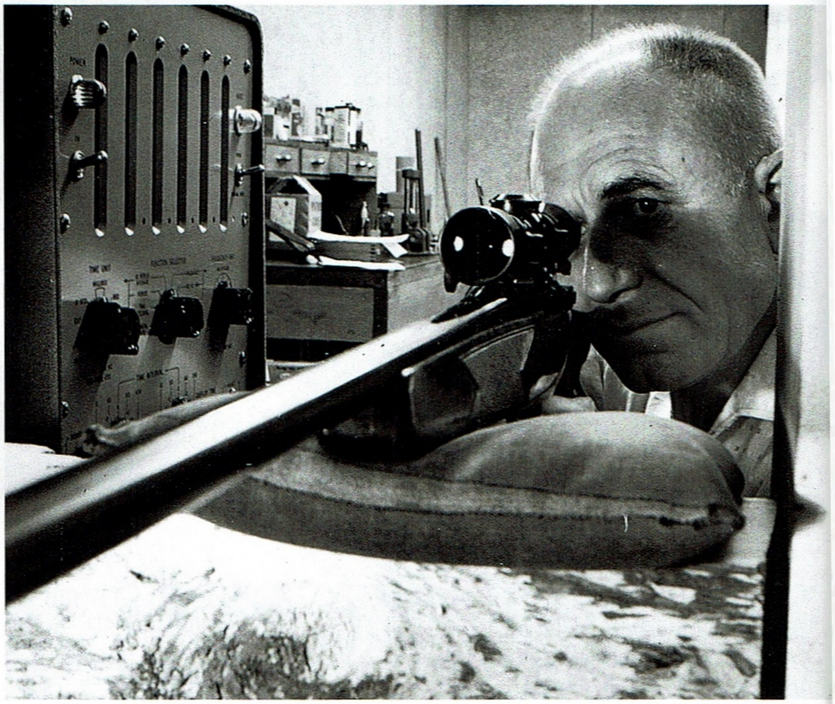
The Publisher and authors make no representations or warranties regarding the accuracy, completeness or timeliness of the information contained in this publication. Any reliance or use of the information is solely at your own risk, and the authors and Publisher disclaim any and all liability relating thereto. Any prices given in this issue were suggested prices at the press time and are subject to change.

Some advertisements in this magazine may concern products that are not legally for sale to California residents or residents in other jurisdictions.

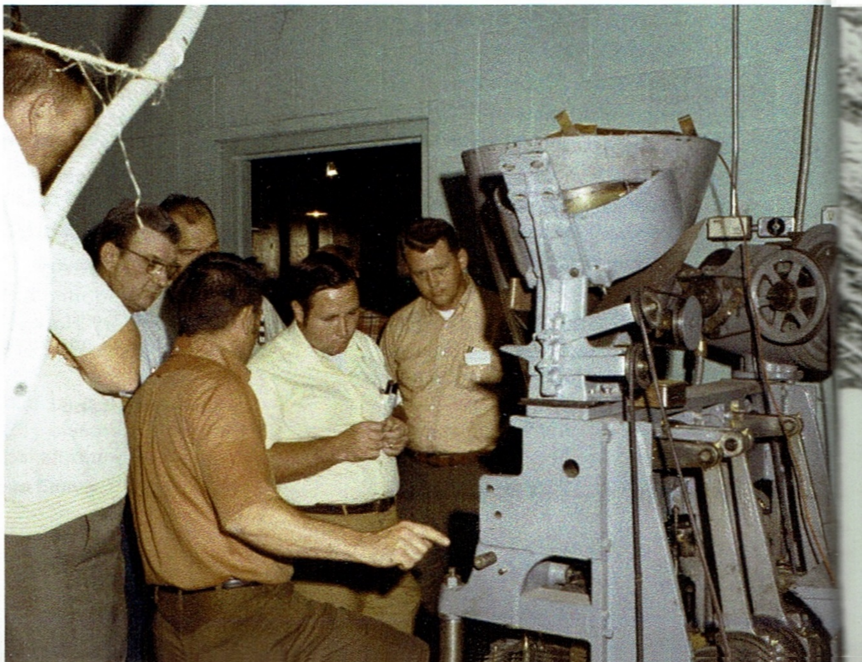
PRINTED IN THE U.S.A.

HORNADY
BULLETS


Hornady
Bullets
unmatched accuracy!
POINT


POWER

HORNADY



By Craig Boddington

It all started in 1949 with a 150-grain, .308-inch spire point made by a man who sought perfection and whose motto, slogan, and credo were, "Accurate. Deadly. Dependable." But Joyce W. Hornady (1907-1981) didn't start out to be a bullet maker.

75 Years of Hornady

Accurate, deadly, dependable bullets ... and much more.

In fact, as a young man, he worked various jobs as a traveling salesman and a dairy farmer. He lost his herd to brucellosis and then made deliveries for a former rival dairy. Like so many, he struggled through the Great Depression.

But Joyce Hornady was no stranger to struggle. His father, a Methodist minister, died when he was young. The family moved from Colorado to Lincoln, Nebraska. His mother got by and raised and educated her children on a small minister's pension. In a marvelous, filmed interview, his widow, Marval Hornady (1913-2015), recalled that he was selling dental supplies when they met and selling printing when they married. As a young man, he hunted mostly small game for the table, but his hobby was target shooting. Marval remembered that he was obsessed with accuracy. "Ten bullets in one hole," then make that one hole smaller.

Their first child, Margaret, was born in 1937, followed by Robbie in 1939. Before the children, they lived in South Dakota, then Colorado, Marval often traveling with her husband on his sales route and sometimes sleeping in their car. Then, with little ones, they were back in Nebraska, Joyce working for Paramount Laundry in Lincoln when the war broke out.

After Pearl Harbor, Joyce Hornady tried to join up. Fortunately, the services didn't need a man in his 30s with two small children. Far better for all of us, he landed a job training marksmanship and firearms safety to the security force at the Grand Island Arsenal. There, he met fellow shooter Vernon Speer. During the war, civilian shooting supplies dried up; the only way to keep shooting was to scrounge and improvise. Like many serious shooters, Hornady had been casting bullets for years. He had a concept that, using empty .22LR cartridge cases, a Linotype machine could be modified to make jacketed bullets.

Hornady found what he needed, and Speer made a bullet-making machine. At the end of the war, Speer quit his job at the Arsenal and moved to Idaho, founding Speer Bullets. For several years, Joyce and Marval Hornady were the primary marketers of Speer's bullets. As the postwar world returned to normal, they opened a sporting goods store: Hornady Sporting Goods Company, selling everything from baseballs to bicycles.

As a sideline, Hornady was making cast bullets for local law enforcement agencies. Hornady believed he could make a better bullet for hunters and reloaders. His bankers were skeptical, giving him a lifelong lesson in entrepreneurship: "A banker is someone who'll lend you an umbrella when the sun is shining."

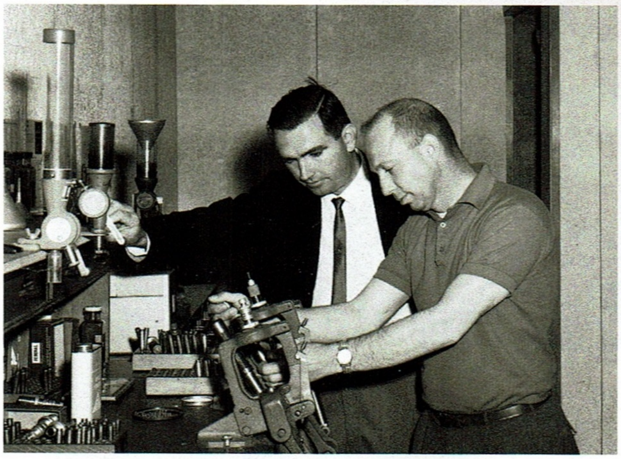
With encouragement from Louis Coleman (who had left Speer) and financing from friend and mentor Fred Abrahamson, Hornady acquired a Waterbury Farrell assembly press, set it up in a former auto body shop in downtown Grand Island, and made a smooth transition from Hornady Sporting Goods Company to Hornady Manufacturing.

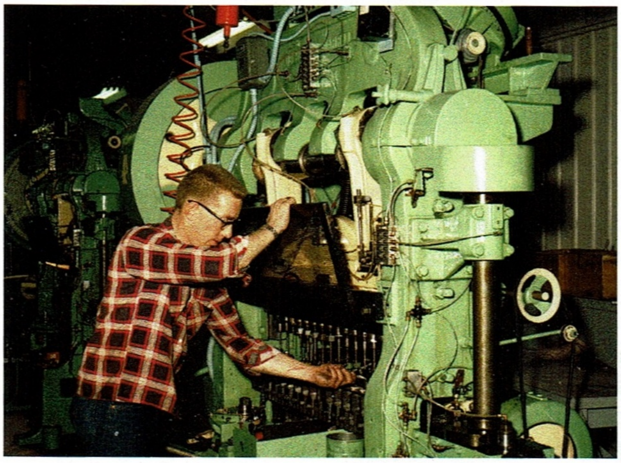
A Bullet Company (and Family) Grows

The 150-grain .30-caliber spire point, still in production, was the first Hornady bullet. Initial sales were mail-order only and based entirely on a small ad in

"American Rifleman" … essentially the only gun magazine in 1949.

Joyce Hornady had been right: American hunters, shooters, and handloaders were looking for better bullets. As Marval Hornady put it, "From the time we put our first bullet on the market, we were in business." The math wasn't quite that simple. In the first year, Hornady Manufacturing sold $10,000 worth of bullets – a lot of bullets in 1949 – but a long way from break-even.



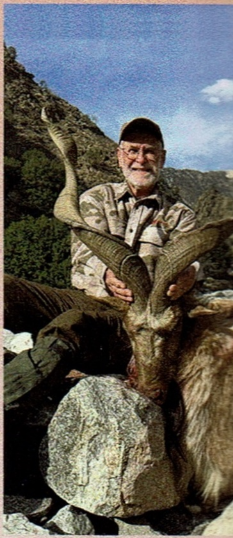


Still, growth was steady. Sales tripled in the second year, diameters and weights also increasing exponentially. Likewise, the payroll grew. In 1950, Hornady Manufacturing doubled to four employees. No doubt a good thing, because in those first years, Marval was busy at home. Her third child, Steve Hornady, was born in 1949.

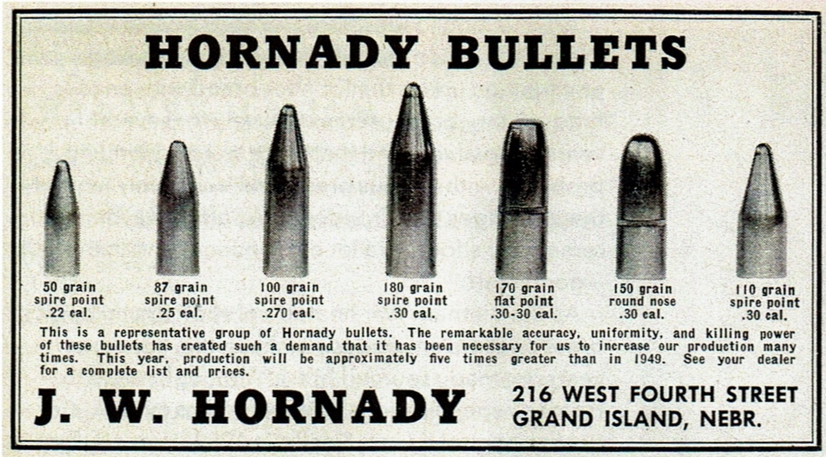
The Korean War caught America completely unprepared, its length and ferocity unexpected. Sudden shortages in critical materials almost crippled Hornady, mitigated by government contracts for unfamiliar products such as condenser cans. When the Korean War wound down in 1953, Hornady refocused on making "Accurate, Deadly, Dependable" bullets, and their early growth resumed.

The family had purchased a half-section of agricultural land on the outskirts of Grand Island where Hornady Manufacturing remains to this day. The first building was finished in early 1958, an 8,000-square-foot facility. Included in that first construction was a 200-yard indoor shooting tunnel. From the beginning, J.W. Hornady personally range-tested every lot of bullets, driving to the Grand Island Rifle Range regardless of weather. Now, for the first time, he could walk downstairs from his office to the ballistic lab and range.

At that time, Marval Hornady estimated the company had eight to 10 employees. The new building seemed huge, but within the year, it wasn't big enough; an extension was added late in 1958. Building a house was her next goal. Her husband suggested the house should wait; still, more space was needed. This time, she put her foot down, and they built their house in 1960.



Steve Hornady with a Kashmir markhor, the mountain hunter's Holy Grail, taken with a .300 RCM, just one of the many fine cartridges introduced under Steve Hornady's leadership.



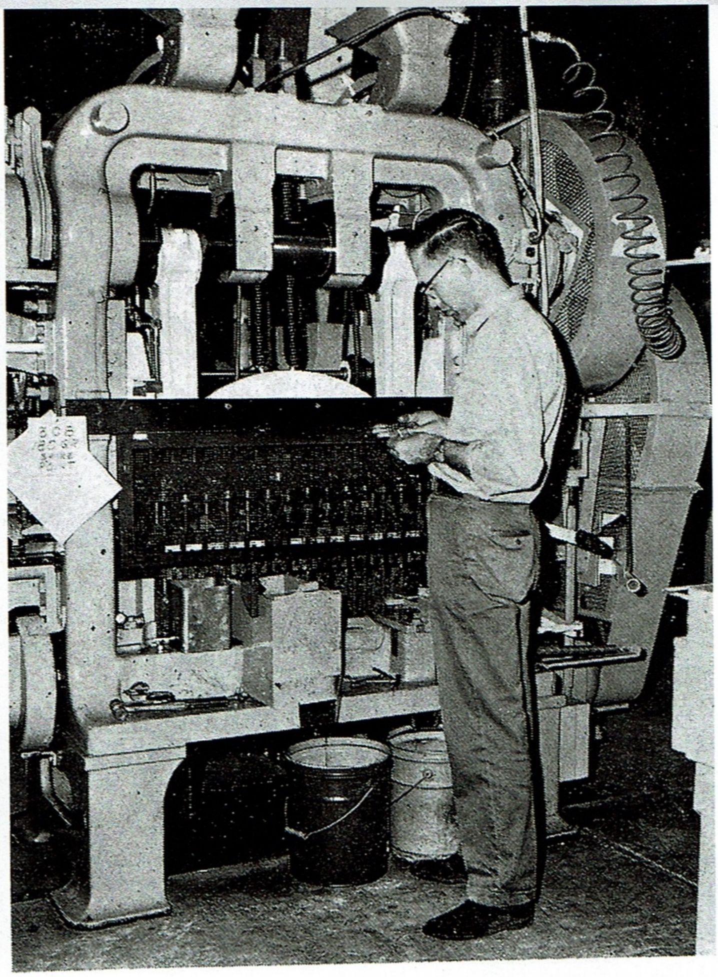
HORNADY BULLETS

50 grain spire point .22 cal.	87 grain spire point .25 cal.	100 grain spire point .270 cal.	180 grain spire point .30 cal.	170 grain flat point .30-30 cal.	150 grain round nose .30 cal.	110 grain spire point .30 cal.

This is a representative group of Hornady bullets. The remarkable accuracy, uniformity, and killing power of these bullets has created such a demand that it has been necessary for us to increase our production many times. This year, production will be approximately five times greater than in 1949. See your dealer for a complete list and prices.

J. W. HORNADY

216 WEST FOURTH STREET
GRAND ISLAND, NEBR.



From Bullets to Ammunition

Hornady moved from component bullets to loaded ammunition in 1964 with Frontier Ammunition. By this time, Hornady had tripled their manufacturing space to 25,000 square feet and had 40 employees, including their first marketing director. Equipment had been upgraded to the most modern available with adequate Waterbury Farrell presses for more capacity. Growth was an astonishing 30 percent per year. J.W. Hornady had also grown; by the 1960s, he was considered a leader in the industry and universally respected for foresight, honesty, and business sense.

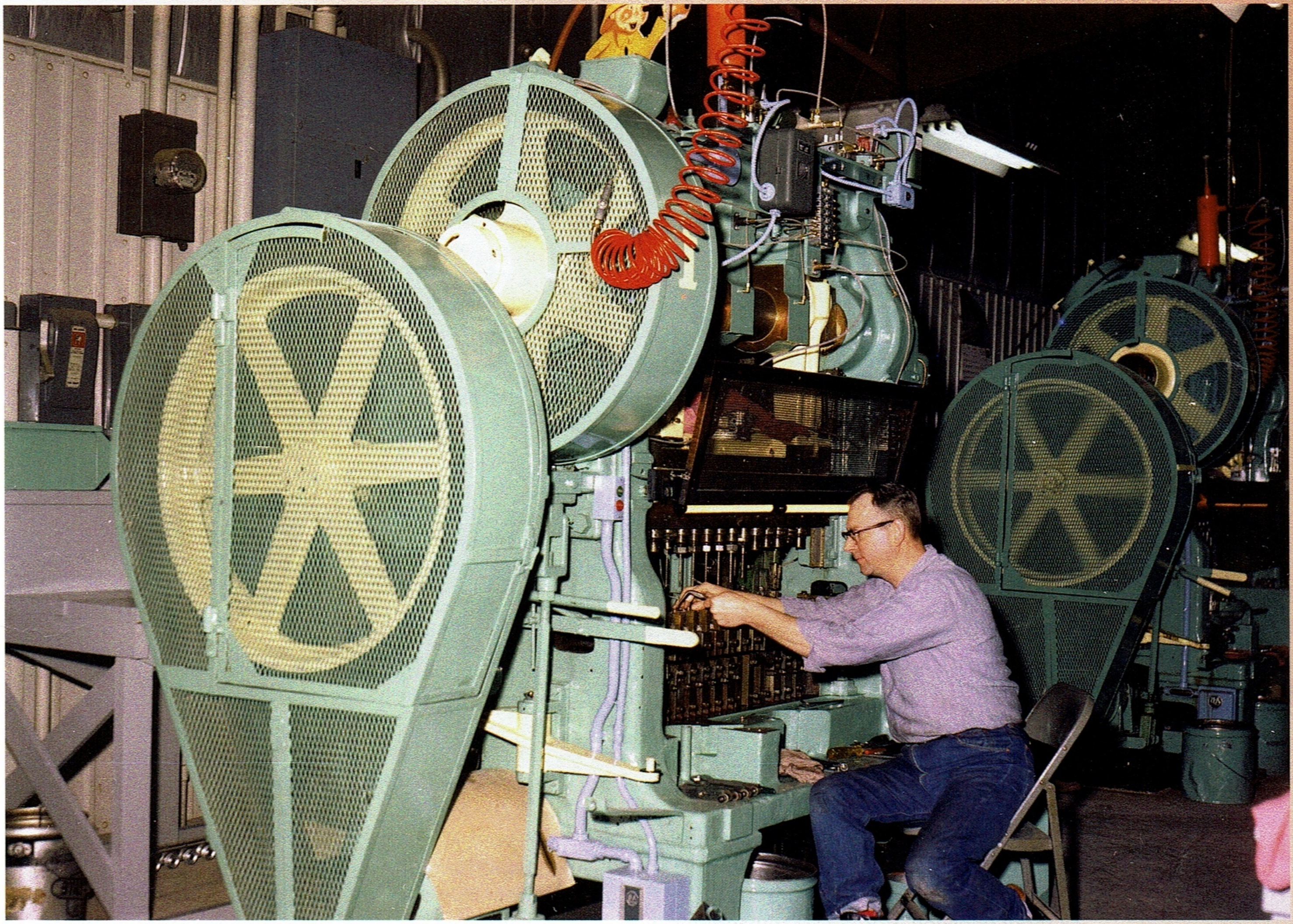
Ammunition loaded with Hornady bullets was a natural extension, and Hornady began loading ammunition under the Frontier brand with once-fired military brass used exclusively for several years. Marval recalled that there were continuing problems with surplus brass, and it certainly limited the cartridges that Frontier could offer. Maybe, but I remember shooting a lot of Frontier ammo in the '60s – good stuff.

As the Vietnam War heated up, sourcing military brass became an increasing challenge. For some years, Hornady sourced brass. Although made to Hornady specifications, this created its own quality-control issues. Finally, in 1984, Hornady began to make its own brass, and Hornady Ammunition as we know it today became a reality. Steve Hornady, now at the helm for four decades, describes the difficult and expensive decision to make cartridge cases as one of Hornady's great turning points.

Pacific Tool

In 1971, Hornady diversified into reloading equipment and wholesaling with the acquisition of Pacific Tool Company and Western Gun and Supply Company. Pacific Tool was one of the oldest manufacturers of reloading equipment. In 1928, Pacific Tool invented the C-type loading press. It had gone through ups and downs, had been acquired by an investor, and relocated to Lincoln, Nebraska. Pacific Tool had just begun to market their inexpensive and versatile M105 shotshell loader, finding rapid acceptance among casual and beginning reloaders. The rapid growth of Pacific and continued success of bullet and ammunition lines made it necessary for Hornady to divest Western Gun to focus attention on core products.

Margaret Hornady David and husband Don David were starting careers with Polaroid. Steve Hornady's late brother Robbie returned from two years in the Peace Corps in Nigeria, going on to acquire a PhD in physics. He worked in Germany for several years and



Dedicated employees have and continue to be the lifeblood of Hornady Manufacturing.

considered joining Hornady. According to his mother, he was "interested in the science of ballistics but didn't find the bullet business challenging enough. Younger son Steve apparently did.

After a stint in Montana, where Jason Hornady was born, Steve Hornady returned to Nebraska and joined the company in 1970. He's been there ever since. During that interview, Marval was asked if Steve was always fascinated by guns and hunting. She laughed, saying that as a child, he hunted and shot but wasn't especially interested. Clearly, this would change.

In the beginning, Marval was a key partner, but by the early 1970s, she hadn't been an employee for 23 years and, according to her, had no intention of going back to work. Joyce Hornady, however, needed her. It seemed there was a pervasive personnel problem ongoing at Pacific Tool that he couldn't quite put his finger on but thought his wife could. So, in 1972, she rejoined Steve and husband Joyce at Hornady Manufacturing. And yes, she sorted things out at Pacific.

The 1970s were good years for the Hornady clan. The business was solid and continued to grow, and Steve was getting his feet under him. Joyce Hornady was able to take some of the hunts he'd always dreamt of to Alaska and Africa. Although she prepared and enjoyed all manner of game meat, Marval was not a hunter, but she loved the outdoors. She went to Africa with her husband three times and loved every minute of it.

Tragedy and Crisis

I well recall the pall that hung over the 1981 SHOT Show in New Orleans. The company plane crashed en route, taking not only Joyce Hornady but engineer Edward Heers and customer relations manager Jim

TOLEDO
NO SPRINGS · HONEST WEIGHT
Hornady Bullets

From bullets to loaded ammunition and so much more, Hornady's product offerings have exploded since its founding 75 years ago.

Garber. I don't claim to have known Joyce Hornady well – I was a young editor at the time – but he wasn't just respected; he was admired and revered. The sense of loss across the industry is hard to describe. The collective loss of leadership, expertise, experience, and knowledge was catastrophic.

Without question, Hornady Manufacturing was in trouble. In the midst of grief at the sudden and senseless loss, the Hornady family needed to dig in. Probably a fortunate thing that, somewhat unwillingly, Marval had gone back to work nine years earlier. She became chairman of the board, and Steve became President. And the family had other resources. Margaret Hornady David and husband Don David left their careers at Polaroid, Margaret assuming vice president and Don taking over as Chief Engineer.

Despite concern across the industry, Hornady survived. One must imagine there was some scrambling, but this new and untried team steered the ship well. Many years later, at a campfire in Africa, Steve talked about this sad time. "Honestly," he told me, "when Dad died, I was in no way prepared or ready to run the company." History suggests he learned fast and well. Remember that key, difficult, risky, and costly turning point decision to make cartridge cases? It was almost certainly taken when Hornady Manufacturing was on the shakiest ground in its corporate history.

Innovation

To this day, Hornady's corporate ethos is to consider themselves a "small company." Hornady is not among the top 10 businesses headquartered in Nebraska. Nor are they America's largest manufacturer of ammunition – but they're far from the smallest. Today, Hornady is a substantial concern and run as Joyce Hornady believed: Find the right people and treat them well. Even in the beginning, J.W. Hornady was known for paying his key employees more than he paid himself. From Joyce Hornady to today, much of the personnel investment has been in a robust engineering department. Possibly unstated in that ethos: Expect the most and the best.

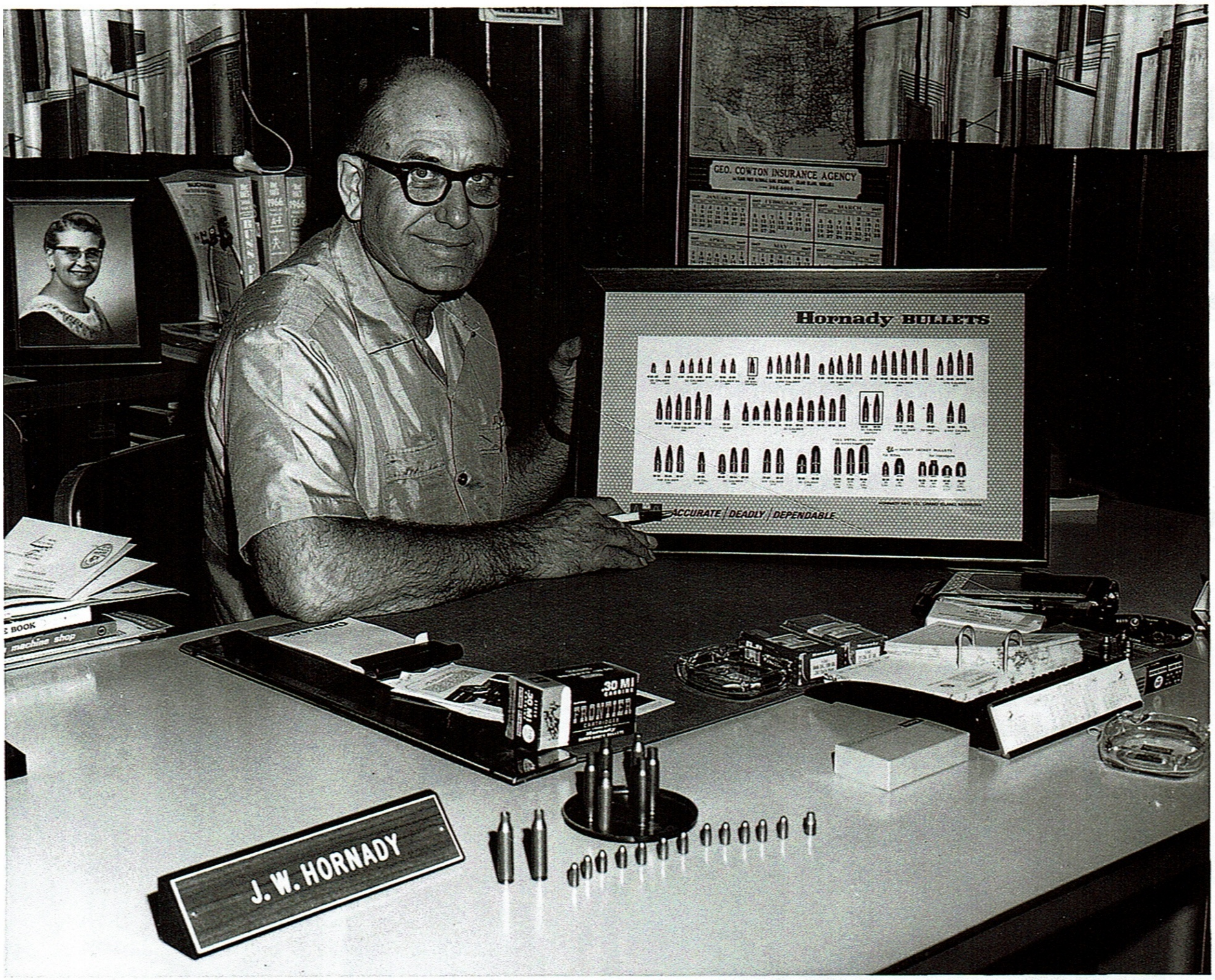
The Hornady team runs hard, runs fast, and their agility in bringing product from concept to market has amazed me throughout my career. This publication will be filled with stories about some of Hornady's key successes. It started with Joyce Hornady. Although well-made and accurate, his early bullets were simple cup-and-core designs. This led to "Innergroove" in 1965 (jacket scored inside the tip), allowing more consistent expansion whether a spire point, round nose, or flat point. This was followed by InterLock in 1977, an interior ring that binds jacket and core together, minimizing jacket/core separation. J.W. Hornady's InterLock remains the basic, simplest, and least expensive Hornady bullet … and it's still "Accurate, Deadly, Dependable."

Oh, my, since then, look what this "small" Nebraska company has given us: LEVERevolution, Superformance, Precision Hunter, ELD-X and Match, Heat Shield tip, and a raft of new loading tools and cartridges! There are always new cartridges, which means there will be winners and losers. Hornady gave us some of the biggest winners in recent years: .17 HMR, 6.5 Creedmoor, .375 Ruger, and, more popular than its daddy, the .375 Ruger's spawn: the PRC family.

Succession

According to Marval, Steve was a "delightful child." Those who know him might not use exactly that term. I've known Steve Hornady more than 40 years. I'd be more likely to use terms like: irascible, ornery, or stubborn. I'd also add in "mischievous prankster." The first time he tried, Steve didn't get a leopard. The second time, mid-point through the hunt, he came back to camp and threw his hat on the table, saying, "That's it. I'm done. I've had enough. I want to leave in the morning."

Deadpan throughout, PHs (except one), outfitter, and me in panic, long after dark, staring glumly into the fire, a drum started, and they paraded Steve's stretched-out leopard skin into the firelight.



In the four decades since his death, Joyce Hornady's company has become the innovation leader of the outdoor industry.

Not exactly an engineering achievement, but you must admit Hornady Zombie loads were, at least, a masterpiece of clever packaging and also a shocking (if short-term) sales success. Father Steve and son Jason Hornady were in bitter disagreement over the Zombie project, which is where I get, at least, "stubborn and mischievous." A fan of zombie lore and legend (and movies), Steve wanted zombie ammo. Jason did not. Jason called me to intercede, asking me to talk his dad out of this zombie madness that might "ruin our company."

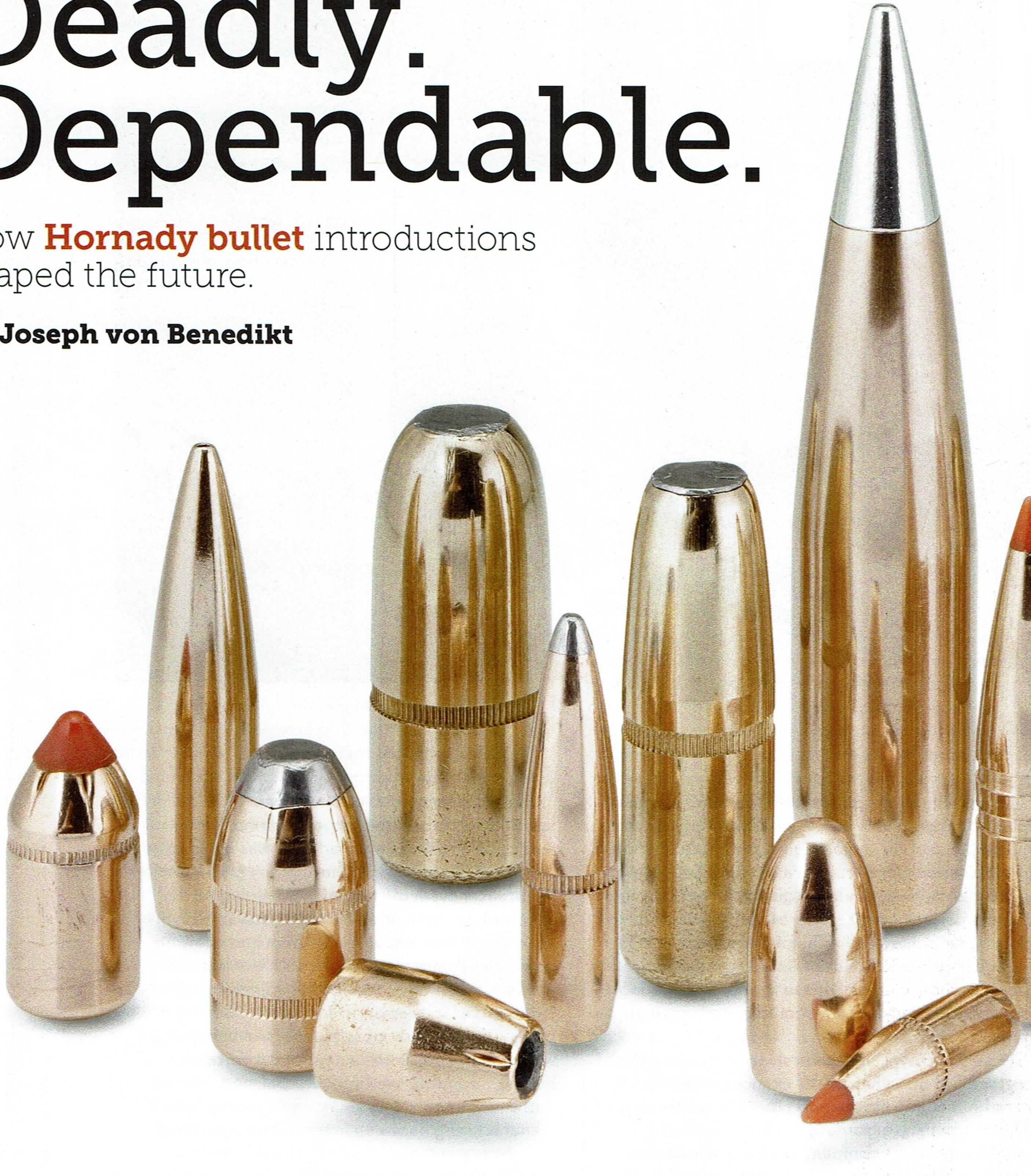
I finally told him, "Jason, surely you know your dad better than I do. What are the chances of talking him out of something he's set on?" That ended the conversation … but Steve Hornady's sense of our industry, his market, and his company has generally worked well, including with Jason.

Jason Hornady rejoined Hornady in 2006. It seemed a bit late in the game but remember his dad's position when his granddad was killed. When Jason got out of college, Steve didn't offer his son a job. Jason went off, stayed in the industry, did well, and returned as a seasoned veteran, assuming duties as current vice president and knowing how other companies work … and how Hornady works. Interestingly, none of the adjectives I applied to his dad exactly apply to Jason. Not irascible, ornery, or stubborn, possibly mischievous (except when it comes to Zombie ammo) but certainly honest, straightforward, thoughtful, and, like his dad and grandad, very smart. In 75 years, Hornady Manufacturing has been in the hands of just two people, two generations … but it appears they are well-prepared for the future.

Accurate. Deadly. Dependable.

How **Hornady bullet** introductions shaped the future.

By Joseph von Benedikt



Innovation ensures a bullet-maker's survival, and few companies through history have innovated as successfully as Hornady.

We'll leave ammunition, handloading tools and techniques, and firearm storage products out of this discussion. This is an article about bullets, the foundation and core of Hornady's business and products.

Launched during lean times post-WWII, Hornady built bullets for hunters who handloaded. Surplus military ammo was plentiful at the time, but it was loaded with full-metal-jacketed bullets unsuitable for shooting big game. Joyce Hornady correctly anticipated a significant need for hunting bullets and began building 150-grain soft-nose, spire-point, .30-caliber projectiles on a Waterbury Farrell press in a former auto body shop.

Hornady's first year in business brought $10,000, a significant sum in 1949 but not enough to break even. The following two decades, Joyce weathered the Korean War, added myriad bullet calibers and weights, maintained an obsessive focus on quality and consistency, and grew Hornady into a multi-million-dollar company.

Then, beginning in 1965, Hornady spawned a culture of innovation within his company, introducing mechanical characteristics that optimized bullet performance in flight and on impact. And that's where our story really begins.

Early Bullet Innovations

"Innergroove" bullets with skived noses inside the jacket that optimized bullet expansion came first, and then InterLock bullets with a mechanical locking ring that bound the core inside the jacket were introduced in 1977. These two features – an InterLock bullet with interior scores in the jacket's nose – not only still exist in Hornady's line, but they comprise a vast portion of the company's bread-and-butter bullets.

Over time, Hornady added FMJ bullets and BTHP target bullets to round out its line of foundational projectiles. Neither were innovative, but the BTHP provided a steppingstone toward a future line that would become a dominating force within its realm: the ELD Match.

When rifle bullets tipped with polymer became popular, Hornady refined the InterLock design with the addition of a signature red polymer tip in 1998 and named the bullet the SST for Super Shock Tip. Its rapid-expansion design became known for accuracy and for instant, explosive mushrooming on impact.

But first came a thin-jacketed, small-caliber version in 1996. Named the V-MAX, it was designed to vaporize prairie dogs and other small vermin. To this day, it remains one of the most popular varminting projectiles ever designed.

Bullet jacket-to-core bonding followed in 2003. The result was a tougher version of the SST named the InterBond. It provided hunters with controlled-expansion and deeper-penetrating performance for game bigger than whitetail deer and proved to be deadly on a variety of African plains game and a spectrum of western game species up to and including elk, moose, and bison.

Hornady's innovative genius burst onto the rifle-bullet scene in 2005 when the company introduced the Flex Tip bullet, a boattailed, pointed design with slightly squishy composite tips that made it possible to safely use pointed bullets in the tubular magazines of traditional lever-action rifles. Available in both component-bullet form and in Hornady's unique LEVERevolution line of factory ammo, the Flex Tip successfully extended lethal distances of lever-action cartridges such as the .30-30 by as much as double thanks to greatly increased aerodynamics.

On a similar timeline, Hornady developed an expanding dangerous-game bullet loosely designed after historic DG bullets from Europe; it featured a lead core inside a robust copper-clad steel jacket.

This free-range sable fell to one 130-grain InterBond handloaded for the author's 6.5x55 while hunting in Mozambique.

> "We as hunters and shooters around the world are the beneficiaries. It's incredible what the company has accomplished during its 75-year life."

Hornady
Dangerous Game Series

Hornady's DGX Bonded dangerous-game bullets are constructed with a lead core bonded inside a copper-clad steel jacket. They provide proven, dependable performance on the gnarliest of big game.

Introduced in 2007, the DGX and it's non-expanding DGS (Dangerous Game Solid) counterpart enabled Hornady to create it's now-legendary line of safari ammunition. Displaying a penchant for old classic DG cartridges no one else made ammo for, Hornady single-handedly revitalized numerous vintage rifles chambered for near-obsolete cartridges and won the loyalty of fine, classic rifle lovers everywhere.

Concurrently, all-copper bullets were gaining steam among certain hunter demographics. Such monometal projectiles are non-toxic, and regulations in parts of California limited hunters to using such ammunition. In 2009, Hornady introduced a polymer-tipped, boattailed monometal bullet made of gilding metal – a copper and zinc alloy – and it proved to be accurate and the deepest-penetrating, non-dangerous-game bullet in Hornady's stable. As such, it quickly gained appeal amongst hunters shooting big-bodied game such as elk with relatively mild cartridges.

Meanwhile, high-performance handgun bullets were brewing. Earlier, in 1990, Hornady's new XTP – for eXtreme Terminal Performance – had won the Product Award of Merit from the national Association of Federal Licensed Dealers. It, too, presaged the future. Although still a staple in Hornady's handgun bullet lineup, the XTP was a steppingstone to the spectacularly innovative Flex Tip and FlexLock handgun bullets, which were introduced in 2012 and are exclusively available in Hornady's factory-loaded Critical Defense and Critical Duty ammunition.

Previously, hollowpoint handgun bullets often failed to expand if the hollow cavity up front got plugged with cloth or other debris that inhibited body fluids from entering and creating the hydraulic action that mushrooms such bullets. These Flex Tip bullets feature tips similar to those in Flex Tip rifle bullets but are a blunter design. They ensure consistent, reliable expansion on impact. Available in light-for-caliber weights that can be pushed fast from traditional self-defense cartridges, Flex Tip handgun bullets are loaded in Hornady's Critical Defense line of ammo and provide outstanding personal protection characteristics with very low overpenetration risk.

Flex Tip/FlexLock handgun bullets feature the addition of a mechanical locking ring inside the jacket. Much like the InterLock ring in rifle bullets, the FlexLock secures the lead core inside the copper jacket and minimizes separation. These bullets are built in heavier iterations and are loaded in Hornady's outstanding Critical Duty line of ammunition. It's one of the few bullets on the market that consistently and spectacularly passes the rigorous FBI test protocol for law enforcement ammunition.

Recent Bullet Innovations

With the advent of rangefinders, dial-up precision riflescopes, and super-accurate long-range rifles, a demand for advanced long-range projectiles became prominent. Rather than taking the easy road and mirroring other regurgitated long-range designs coming to market – which tended to be standard target bullets optimized for a bit less aerodynamic

This tremendous warthog fell to a single 139-grain GMX from the author's 7mm Rem. Mag., after offering a fleeting "Texas Heart Shot" opportunity at 349 yards. The bullet centered the warthog's tailpipe, penetrated nearly three feet, and was found against the jawbone.

drag – Hornady's design team took on a significant challenge: Reinvent the long-range bullet, both in target and hunting iterations, and render traditional designs obsolete.

Refusing to accept any result that didn't fulfill that decree, Hornady's engineers worked several years, refining and finessing the concept to fruition. Doppler radar proved to be a crucial asset, as it uncovered an erosion issue with traditional Delrin polymer tips when they are used in high-BC bullets and fired at more than 2,500 fps. This led to the development of the space-age, erosion-resistant composite Heat Shield tips used in the new hunting and target bullet lines.

Doppler also assisted engineers in massaging boattails and secant nose profiles for minimum aerodynamic drag and enabled the calculation of bullet drag coefficient, a significantly more accurate way to predict long-range projectile ballistics.

Introduced in 2016, the new hunting and target bullets were given the acronym ELD, for Extremely Low Drag. The ELD Match features superbly concentric, thin AMP copper jackets and soft lead cores that take rifling consistently.

Thanks to extensive Doppler-assisted research, the design team was able to maximize drag coefficient – or more conventionally put, BC – with the result that ELD Match bullets tend to have best-in-class BCs amongst composite-tipped bullets.

Hunting ELD-X bullets (for Extremely Low Drag eXpanding) were inherently more challenging, because in addition to optimizing flight and accuracy characteristics, they required engineering for terminal performance. They had to hold together reasonably well when impacting at high velocities up close to

the hunter, and they had to mushroom reliably when impacting at low velocities far downrange.

These two performance characteristics are diametric opposites and always require bullet designers to perform a balancing act. Hornady's engineers took to the field and shot an array of game with several different iterations, returning to the lab and refining performance after each foray. More than satisfied wit the final result, they came to market with a product that would redefine hunting bullet versatility.

Generally heavy for caliber, the ELD-X quickly became known for superlative accuracy and fast kills. Hornady didn't just create bullets that fit the normal weights; the company endowed ELD-Xs with unique weights that proved to have optimal characteristics fo certain cartridges. For example, .30-caliber versions for the .308 and .30-'06 weigh 178 grains, while those designed specifically for the .300 Win. Mag. are 200 grains and have a relatively short nose compatible with .300 Win. Mag. standard-length magazine boxe ELD-Xs for modern long-range cartridges such as the .300 PRC are of 212 grains and feature a long, fine-entry nose that significantly boosts aerodynamics. Each within its own comfort zone, provides best-in-class ballistic coefficients combined with easy accuracy characteristics.

Never one to sit upon its laurels, Hornady revisited the dangerous-game, big-bore bullet lineup, replacing the standard DGX copper-clad, steel-jacketed bullet with a version sporting bonding between the lead core and steel jacket. The DGX Bonded bullet solved the few complaints from customers that felt the old DGX was a bit too soft and resulted in a top-notch big-bore bullet that performs with the best of the best.

Subsequently, the brand-new, unprecedented SUB-X bullet – a heavy-for-caliber, Flex Tip bullet designed to mushroom at subsonic speeds (for proper suppressed hunting) – hit the market. As

Left: Hornady's most technical contribution to the cutting-edge realm of modern bullets is the ELD-X. It forever reshaped the way long-range hunting projectiles are judged. The author used a 200-grain ELD-X out of his .300 Win. Mag. to take this exceptional old red stag in Argentina.

Below: In 2019, the author fulfilled a lifelong dream and took a heavy-horned old cape buffalo bull with 400-grain DGX Bonded bullets in a .416 Ruger.

always, Hornady did the unexpected and loaded the SUB-X in cool cartridges ranging from the .300 Blackout to the .30-30 Win. and .45-70 Gov't.

By 2018, Hornady as a company was in a state of vast expansion. They were introducing the most successful new cartridges since the 7mm Rem. Mag. and .300 Win. Mag. of the 1960s. Hornady bullets were dominating PRS, the fastest-growing shooting sport in the nation. New cutting-edge muzzleloader bullets and handgun bullets and target bullets and hunting bullets and predator and varmint bullets were pounding out of presses 24/7, and more new designs were brewing in the R&D lab.

Most significant was the A-TIP. Much like an ELD Match bullet but with a more expensive, lathe-turned aluminum tip that enables absolute consistency and drag coefficients that even outclass the ELD Match, A-TIP bullets are made in small-batch manufacturing, with each box containing 100 consecutively created bullets that never pour into high-volume bins or get tumbled in soapy water. A-TIPs are the pinnacle of target-bullet design, meaning they showcase appropriate prices and championship trophies.

Not in the least designed for hunting, A-TIP bullets are the ideal extreme-range, lead-core target projectile. They boast the best BCs ever seen, and in good rifles, even 10-shot groups cluster like flies, each bullet stacking atop the last.

As the world economy lagged but the shooting sports soared during the COVID scare, Hornady refined a new version of the GMX bullet, giving it a slightly different, more responsive alloy, Doppler-refined profiles for enhanced aerodynamics, and the Heat Shield tip engineered for the ELD bullet lines. Dubbed the CX, for Copper eXpanding or Controlled eXpansion (take your pick; both apply), the new monometal bullet also featured more consistent accuracy and heavy-for-caliber weights that optimized long-range performance and extremely deep penetration.

Opening Pandora's Box

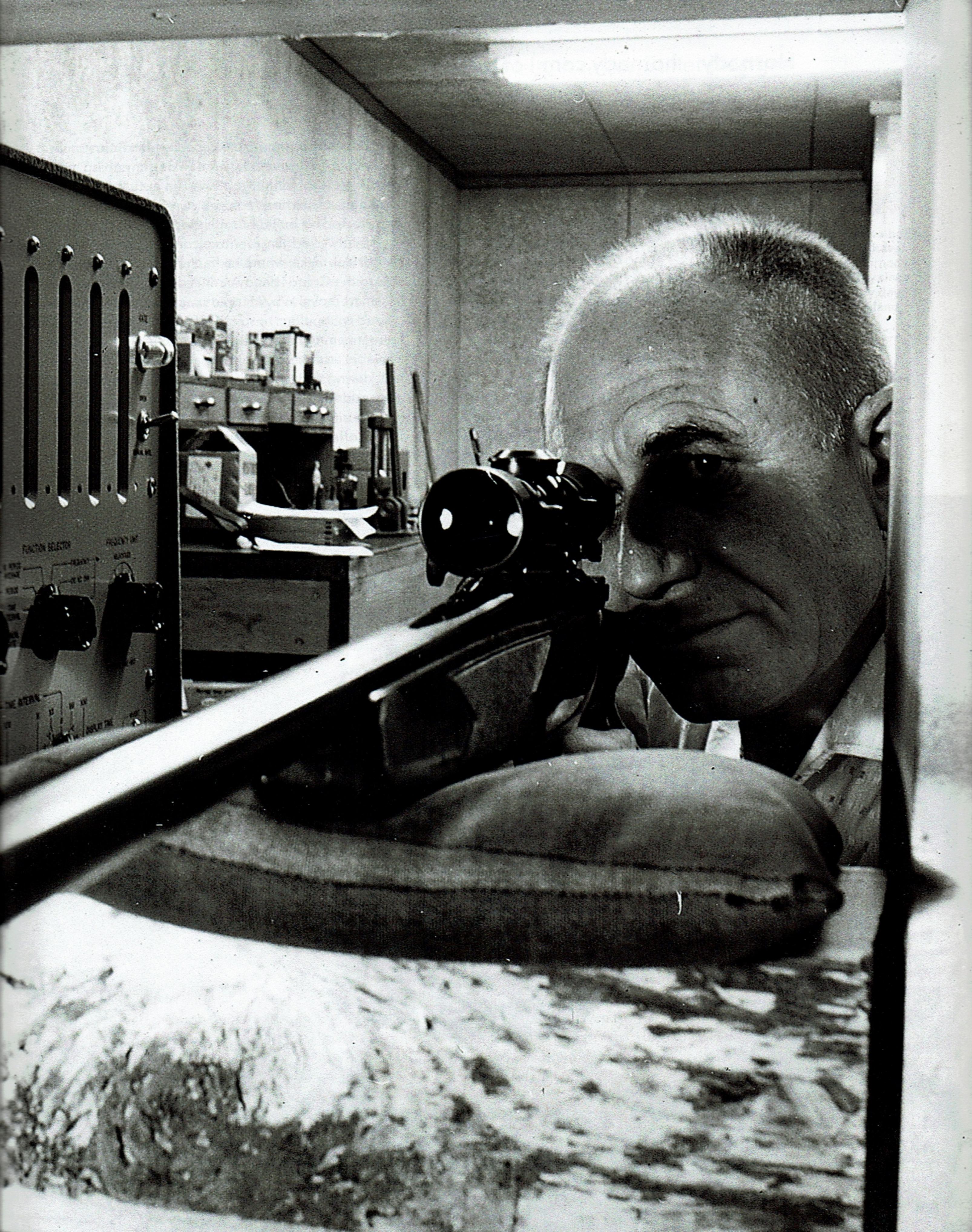
Hornady doesn't just think outside the box; they explode the box. From the muzzleloading Bore Driver ELD-X bullet just brought to market to the most advanced 4DOF ballistic app available to the cutting-edge new reloading tools introduced every year, Hornady continues to innovate. We as hunters and shooters around the world are the beneficiaries. It's incredible what the company has accomplished during its 75-year life. I find great delight in imagining what the next three-quarters of a century will bring.

Hornady: From Startup to Innovative Bullet Designs

Understandably, it's easy to overlook (or care about) history when sending a bullet downrange. But, it's almost certain that Joyce Hornady and his company influenced that bullet's design. Here's your history lesson.

By Aaron Carter

Few companies in the outdoor industry – let alone ammunition manufacturers – have the name recognition as does Hornady of Grand Island, Nebraska. In fact, for those who recreate in the outdoors and particularly in the realms of shooting and hunting or believe in the right to protect oneself using lethal means, it's a household name. That's not by happenstance, though; ceaseless innovation and a penchant for excellence has made Hornady a world-renown supplier of ammunition, handloading components and equipment, and firearms-related accessories that firearms owners identify with and trust.

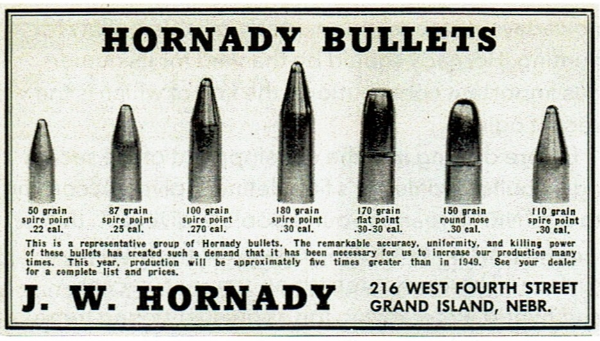

FUNCTION SELECTOR
FREQUENCY UNIT
TIME INTERVAL
DISPLAY TIME

Striking Out ... Until

Like the other famous "founding fathers" of creative, component bullets, Joyce Hornady sought to solve a problem. "The initial focus was simply because he was an avid shooter and varminter, and the available bullets at the time simply didn't shoot well," shared Seth Swerczek, marketing communications manager for Hornady. "He was missing targets and prairie dogs not because of his shooting or reloading techniques, but rather the bullets available at the time simply weren't accurate enough. So, he set out to make a more accurate bullet for the exacting reloader."

Unfortunately, Hornady's enthusiasm for manufacturing inexpensive yet accurate and reliable projectiles for handloaders wasn't shared by those who had the means to fund his venture – banks. But, as author, entrepreneur, and speaker Jim Rohn once commented, "If you really want to do something, you'll find a way. If you don't, you'll find an excuse." There were no excuses here; Hornady was determined and thus started his bullet business in 1949.

Hornady's fledgling venture commenced in Grand Island, Nebraska, where he had taught marksmanship to the Grand Island Arsenal during World War II – smart move. Why? Surplus cases and ammo, albeit loaded with bullets unsuitable for hunting as well as remnant ammunition-making equipment, were readily available afterward. The company grew rapidly. In fact, during their second year alone, sales tripled. Staff were added. And then came the Korean War. The lean times during the conflict required that Hornady diversify his offerings to support the war effort, such as



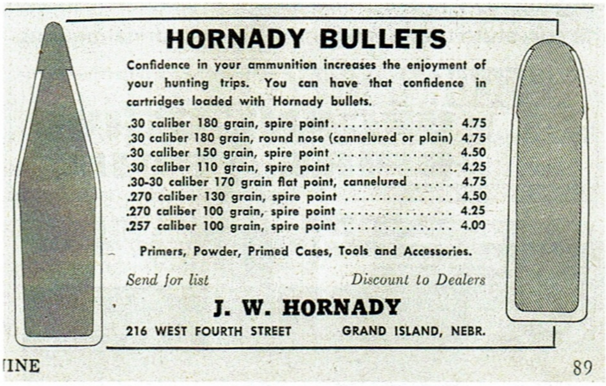
HORNADY BULLETS

50 grain spire point .22 cal.
87 grain spire point .25 cal.
100 grain spire point .270 cal.
180 grain spire point .30 cal.
170 grain flat point .30-30 cal.
150 grain round nose .30 cal.
110 grain spire point .30 cal.

This is a representative group of Hornady bullets. The remarkable accuracy, uniformity, and killing power of these bullets has created such a demand that it has been necessary for us to increase our production many times. This year, production will be approximately five times greater than in 1949. See your dealer for a complete list and prices.

J. W. HORNADY
216 WEST FOURTH STREET
GRAND ISLAND, NEBR.

Innovative bullet designs have been Hornady's specialty since the early days in Grand Island.



HORNADY BULLETS

Confidence in your ammunition increases the enjoyment of your hunting trips. You can have that confidence in cartridges loaded with Hornady bullets.

.30 caliber 180 grain, spire point	4.75
.30 caliber 180 grain, round nose (cannelured or plain)	4.75
.30 caliber 150 grain, spire point	4.50
.30 caliber 110 grain, spire point	4.25
.30-30 caliber 170 grain flat point, cannelured	4.75
.270 caliber 130 grain, spire point	4.50
.270 caliber 100 grain, spire point	4.25
.257 caliber 100 grain, spire point	4.00

Primers, Powder, Primed Cases, Tools and Accessories.

Send for list *Discount to Dealers*

J. W. HORNADY
216 WEST FOURTH STREET GRAND ISLAND, NEBR.

INE 89

Hornady's first bullet, the spire point, has remained one of their most popular offerings.

making condenser cans, so the company could remain afloat. Those were temporary yet necessary pains.

With yet another war ending, demand for Hornady's bullets rebounded. Within nine years of the company's founding, the growth required that he move his company to an 8,000-square-foot building, where it is still located today. Most important, though, was that the latest facility had a 200-yard underground range where he could personally test the newer bullets that his company was steadily innovating; trips to the Grand Island Rifle Range – in all seasons and weather conditions – were eliminated and so was wasted time.

It's worth noting that, although the company was founded on the premise of providing handloaders with top-quality projectiles, Hornady himself had the foresight to know that not everyone reloads, and ensuring unimpeded access to Hornady bullets would require adding loaded ammunition to the company's offerings. This was accomplished by loading their projectiles into surplus military brass, which Hornady debuted as Frontier Ammunition in 1964. However, America's next war, Vietnam, would require transitioning to new brass cases, thus the stage was set for modern Hornady Ammunition. As an aside, military-grade Frontier Cartridge ammo is still cataloged.

Given their continued (and increasing) success with bullets and ammunition, during the 1970s, the company diversified with loading tools. According to Hornady's website, "In 1971, the company diversified into reloading tools with the acquisition of Pacific Tool Company … one of the oldest manufacturers of reloading equipment." What better way to sell Hornady component bullets than to also sell the equipment to load them, right? Clever. Today, the company continues to carry an immense assortment of equipment for producing top-tier handloads.

Projectiles and Promises

According to Hornady's website, "the first Hornady bullet was a .30-caliber, 150-grain spire point, a bullet that has, from the beginning, been one of the most popular in the Hornady line." It's unsurprising that Joyce's first bullet be well-suited for the .30-'06 Springfield cartridge. After all, at the time of the company's founding mid-century, the cartridge had faithfully served through two world wars, and surplus rifles along with new hunting rifles in the chambering abounded. So was remnant ammo and brass. Other .30-caliber cartridges, such as the .300 H&H Mag., were on the scene as well, so Joyce's decision was prudent.

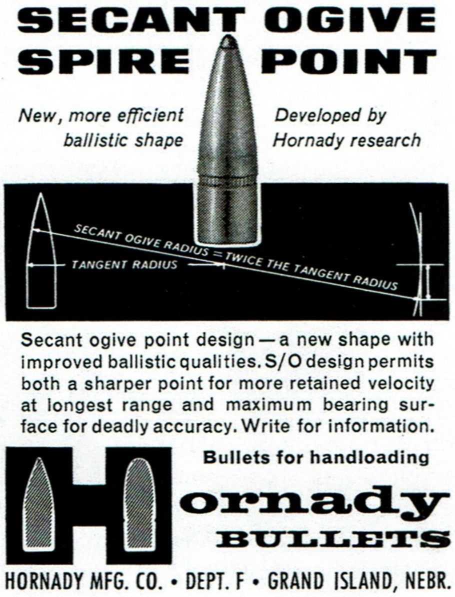
When compared to today's newfangled projectiles, the basic "cup-and-core" projectile – in this case, the original Hornady .30-caliber, 150-grain spire point – is unimpressive in appearance. Truth be told, its looks belie its accuracy potential and on-game prowess. Even today, the bullet and its brethren, which are found in the InterLock line, are tough to top at practical distances. As the years passed, Hornady's offerings continued to increase – and they still do – but the same commitment to quality has remained steadfast.

Joyce subscribed to the maxim, "accurate, deadly, dependable," which is still the foundation of the company today. Moreover, he was staunchly committed to quality control. "Even in a little thing like a bullet, quality pays," remarked Hornady in a newspaper interview. In fact, he was so dedicated that he coined the phrase, "ten bullets in the same hole." Knowing that customers could (and would) put that statement to the test could be perceived as foolhardy or an assurance; the latter applied to Joyce Hornady. By committing to that above-average standard, Hornady was essentially required to maintain/improve quality control and innovate. And that he did.

Making Bullets Better

Given the surfeit of svelte, streamlined projectiles with ever-increasing ballistic coefficients (BC) available nowadays, not to mention utterly reliable bullets for hunting, Hornady should be thanked for its numerous important contributions, the first of which is the secant ogive.

Before delving into the development of the secant ogive bullet profile, let's first define "ogive." According to the "NRA Firearms Sourcebook," ogive is, "...the curved portion of a bullet forward of the bearing surface." There are three types: tangent, secant, and hybrid. Referencing the abovementioned tome, tangent ogive is described as, "...a projectile nose with the curvature that is tangent to the cylindrical bearing portion," while the secant ogive is, "...a projectile nose with the curvature not tangent to the cylindrical bearing portion." Logically, the hybrid ogive is the modern melding of the two profiles to attain the best benefits of each while reducing drawbacks.


SECANT OGIVE RADIUS = TWICE THE TANGENT RADIUS
TANGENT RADIUS

SECANT OGIVE SPIRE POINT

New, more efficient ballistic shape

Developed by Hornady research

Secant ogive point design — a new shape with improved ballistic qualities. S/O design permits both a sharper point for more retained velocity at longest range and maximum bearing surface for deadly accuracy. Write for information.

Bullets for handloading

Hornady BULLETS

HORNADY MFG. CO. • DEPT. F • GRAND ISLAND, NEBR.

Hornady set the stage for modern hunting bullets with the development of the secant ogive, which offers superior aerodynamics, flatter trajectory, and retained velocity on impact.

Field & Stream
Outdoor Life
Sports Afield
July, 1962

Why does this matter? As a guideline, bullets with a tangent ogive – the traditional profile – are easier to tune to a given rifle, as they're less sensitive to seating depth and thus jump to the rifling. That said, they have lower BCs than projectiles of the same length with a secant ogive; therefore, all else being equal, the more aerodynamic secant ogive bullets have a flatter trajectory, are less influenced by the wind (deflection), and arrive on target with more velocity and energy. Retained velocity is critical with bullets earmarked for hunting, as falling below a specific threshold for reliable expansion – every bullet is different in this regard – can result in a minimally or non-expanding projectile that's inadequate for rapid expiration of game. Think full metal jacket (FMJ) or near it.

"Virtually every bullet we manufacture today is a secant ogive," shared Swerczek. Why? "Easy to manufacture, great accuracy, [and] wonderful efficiency," he added.

Modern hybrid bullets offer the best of both worlds. They're easy to tune and ballistically efficient.

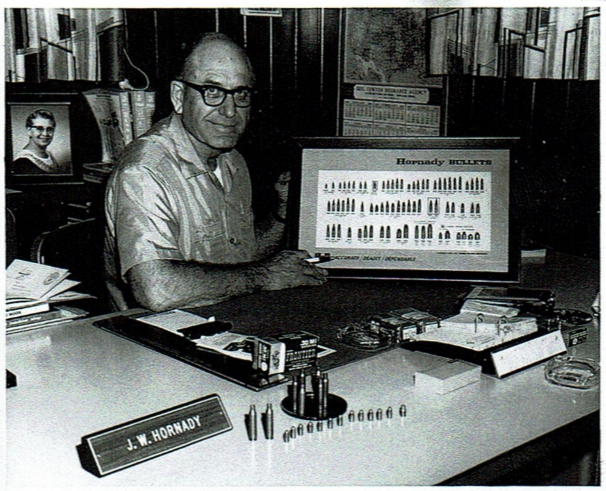
How does Hornady fit into the picture? According to their website, "the ballistic lab supported experimentation that led to the secant ogive spire point shape common to all pointed bullets currently."

"The secant ogive profile was developed [by] the U.S. Army ballisticians," clarified Swerczek. "[During the 1960s], Hornady was one of the first bullet companies to test this profile with the Army [as well as] bring it to market in a commercially available product. The secant ogive was a big step [forward]." They're plentiful now.

Further illustrating Hornady's commitment to innovation, the company unveiled the "Innergroove" design in 1965. Reliable, consistent bullet expansion is tricky, as much depends on what it strikes (or doesn't) and its impact velocity. Hornady's solution: scoring.

"Innergroove bullets were scored on the inside of the [tapered] bullet jacket tip, ensuring consistent mushrooming whether the bullet was a spire point, round nose, or flat point," reported Swerczek. "This was important because it made for a more consistent product regarding terminal performance." You'll find this feature on Hornady's current offerings as well. Reliable expansion, while important, does little if the projectile cannot maintain its integrity to penetrate deeply. As such, Hornady's next innovation focused on just that.

Another improvement to Hornady bullets debuted just over a decade later, in 1977. In general, traditional, cup-and-core-type projectiles perform admirably on game. But there is a drawback and one that's accentuated with increases in velocity, particularly approaching or surpassing the 3,000 fps mark. Without some means to secure a lead-alloy core to the gilding metal jacket, jacket-core separation is a real possibility during the expansion and penetration. While the wounding effect is exacerbated, penetration is sacrificed. This is less of a concern on medium-size game, such as whitetail deer and antelope, but it's a potential problem on larger species, such as elk, or dangerous quarry. That's why many newer, "premium" hunting bullets integrate crossmembers, bonding, or mono-metal construction to maintain integrity; tapered jackets aren't enough with ultra-high-velocity impacts.



Joyce Hornady had a simple and novel approach to remedying the dilemma: the InterLock bullet. Said bullets have an interior ring that mechanically locks the core and jacket together, thereby reducing the chances of the two parting. How is it added?

"The InterLock is applied into the bullet jacket during the draw process, and the [one-piece] core is seated into it, thereby 'locking' them together," explained Swerczek. This is augmented by the cannelure. "[So successful is the design that] InterLock rings can be found in many of our products from .22 caliber up to .50 caliber – from centerfire, muzzleloader, and shotgun," added Swerczek.

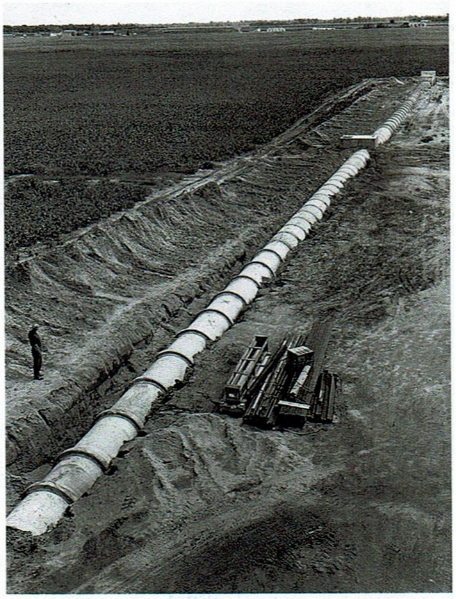
Granted that I've not personally pitted InterLock bullets against elk-size species (though I know of those who have), whenever my friends and I have employed them on whitetail deer and even the largest grain-fed Midwest brutes, I've yet to witness a failure. Either the bullet is present and mostly intact – weight loss can be expected – or it's buried somewhere in the ground behind the animal. Either way, it did its job, and the recovery process is usually short. In fact, so trusted are InterLock bullets that my go-to for a cherished, bull-barreled Remington Model 700 .243 Win. is the unassuming, 100-grain boattail spire point (BTSP). Besides providing superior accuracy – .5 MOA and less at 100 yards – it kills way out of proportion to its size, so why change? And that's far from the only rifle of mine that relies on InterLock bullets.

Continuing Joyce's Vision

Tragedy struck Hornady in January 1981, when Joyce, along with several other Hornady employees, were killed in an airplane crash while en route to SHOT Show in New Orleans, Louisiana. Although Hornady's visionary was gone, the family ensured that the company continued to move forward. It just required a significant commitment, which was nothing new for Hornady.

In the four-plus decades since Joyce's passing, Hornady has grown immensely, thanks to ceaseless innovation across the board, particularly regarding ammunition and bullets. Concerning the latter, Hornady continues to offer handloaders – their original clients – a plethora of projectiles from which to choose. Whether you're pursuing whitetail deer on the back forty, stalking a pachyderm in remote Africa, eliminating four-legged predators and pests, or chasing the target's X-ring from 100 yards to past a mile, thanks to perpetual advancements, Hornady has a top-tier bullet for the task. For instance, in component rifle bullets alone, there are 19 different designs, ranging from the renowned V-MAX and InterLock to the DGX and ELD Match. Yeah, they have you covered. The same applies for handgun bullets; six diverse lines are available to handloaders. And, the company shows no sign of slowing, either. That's the Hornady way.

To save time traveling to and from the range, Joyce Hornady constructed a 200-yard underground test facility at the Grand Island plant.



Famed Brazilian soccer player Edson Arantes do Nascimento, also known Pelé, once commented, "Success is no accident. It is hard work, perseverance … sacrifice, and most of all, love of what you are doing or learning to do." That statement perfectly captures Joyce Hornady. His disciplined pursuit of his vision, despite challenges out of his control, kept the company moving forward, and they have remained that way even after his passing. Steadfastness with regard to product development, trustworthiness, and absolute quality control has garnered Hornady a fanbase the world over. There's little wonder why the name is familiar.

Reviving

Hornady
LEVEREVOLUTION
30-30 WIN
160 gr FTX®

Lever Guns

Hornady's pointed FTX bullets bring new life to classic cartridges.

By Joseph von Benedikt

Historically, lever-action rifles fed with tubular magazines couldn't safely use pointy bullets that fly through the air with minimum drag.

Hornady
LEVEREVOLUTION
20 CARTRIDGES
45-70 GOVT
325 gr FTX®
#82747

Thanks to squishy, pointed tips that won't detonate a primer in a tubular magazine, Hornady's Flex Tip bullets provide much-improved aerodynamics over the traditional flat-nosed bullets historically required.

Why not? Because with cartridges stacked in a nose-to-tail column in the magazine tube, with the pointed tip of each bullet against the primer of the cartridge atop it, accidental primer detonations would occur. Flat-nose and broad bullets were the only appropriate projectiles for lever-gun lovers.

As a result, effective range was rather curtailed, as broad-nosed bullets fly with the aerodynamics of a pumpkin.

This factor wasn't viewed as crippling. Hunters equipped with lever-actions tended to be traditionalists and didn't mind stalking in close. At least, that's what most rifle and ammunition companies thought. Then, Hornady invented a pointed bullet safe for use in tubular magazines and turned the lever-action hunting scene on its ear.

Named the FTX, Hornady's new bullet had a patented "Flex Tip" in its nose. Made of a material just squishy enough to compress rather than dent into a primer, the Flex Tip accomplishes two things: Foremost, of course, it prevents chain-firings in magazines. Less obviously, its near-hydraulic properties effectively initiate bullet expansion at low impact velocities.

Suddenly, .30-30s and their lever-action cartridge kin weren't just 150-yard propositions. A good rifleman with an accurate Winchester or Marlin could place shots effectively to near double that distance.

This FTX bullet extended into crossover revolver/lever-action cartridges, too, including the .357 Magnum, .41 Magnum, .44 Magnum, and .45 Colt. And while none of these are much good for hunting past 100 yards, the FTX bullet does enable projectiles from these cartridges to hold on to velocity and energy a bit better downrange and to expand more reliably on impact.

Before we look at some hard numbers to quantify just what a difference the FTX bullet makes in flight, it's worth noting there is another factor at play, too: Hornady introduced the FTX bullet in a new, dedicated ammunition line called LEVERevolution. It features state-of-the art propellants tuned to provide the best velocity possible in lever-action cartridges.

FTX bullets are finessed in weight to provide best flight characteristics for each caliber with little regard to conventional bullet weight parameters. For example, the .30-30 Winchester was given a 160-grain FTX – smack between the traditional 150- and 170-grain offerings. The .45-70 was endowed with 325-grain FTX bullets, not the traditional 300- or 400-grain bullets usually loaded in the cartridge.

Naturally, Hornady introduced LEVERevolution ammo and the FTX bullet in the most popular lever-action cartridges, starting with .30-30 Winchester and .45-70 Gov't. Soaring success provided proof of concept, and like dominoes, Hornady added less popular lever-action cartridges, revitalizing thousands of old rifles chambered in .35 Remington and .32 Win. Special and .444 Marlin. Near-obsolete cartridges such as the .25-35 Winchester and .348 Winchester followed.

Concurrently, in a combined project between Hornady and Marlin, two brand-new cartridges were introduced to boost the potential of tube-fed lever-action rifles: The .308 Marlin Express and the .338 Marlin Express. Higher-than-traditional max pressures optimized the potential of strong Marlin actions. Muzzle energies matched those of the .308 Winchester and the .30-'06. Conceptually great, both cartridges were dealt a blow when Marlin went through a series of ownership and location changes, and production faltered.

As the LEVERevolution ammunition line matured, Hornady added a new twist on the FTX bullet to the .30-30 and .45-70 offerings: The MonoFlex. As the name suggests, it's a monometal bullet made of a copper alloy, topped with squishy Flex Tips. Necessarily lighter in weight than their lead-core brothers, MonoFlex bullets provide a legal option in lead-restricted areas. More importantly, they provide a deep-penetrating option for hunters who want a bullet to break through heavy bones and still drive deep and straight.

While hunting black bears in Alberta, I helped fellow writer Aaron Smith perform informal forensics on a big boar he'd shot with a .30-30 loaded with 140-grain MonoFlex bullets. The bear had been quartering steeply away, head low, and had dropped at the shot without a twitch.

We traced the bullet's path from where it entered just behind the shoulder, impressed with the trauma caused as it traveled forward into the bear's muscular neck. About seven vertebrae back from the skull, the MonoFlex entered the bear's spinal column, traveling forward up its length. We then knew why the bear had dropped without a twitch. Vertebra after vertebra was pulverized. Shocked, we tracked the MonoFlex's path to the rear of the skull where we lost it. The skull itself had no visible damage, but the vertebra it attached to was shattered like the rest.

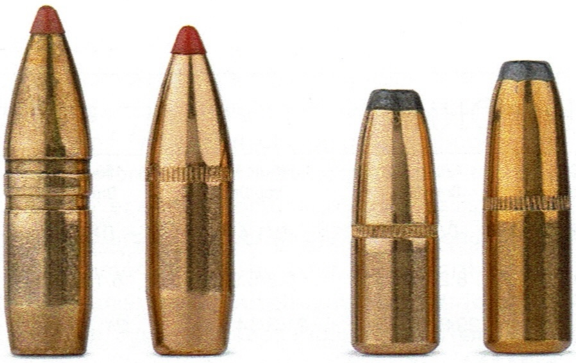
Finally, baffled but determined, I began methodically removing brain matter from the opening in the rear of the boar's skull. Deep inside the cavity, something clinked against my spoon, and I lifted out the MonoFlex bullet. Incredibly, it had penetrated a couple feet worth of bear hide, muscle, and vitals and shattered seven spinal joints into matchsticks before penetrating the bear's brain and coming to rest there.

The Ballistic Advantage

Most of the various calibers of FTX bullets provide a distinct advantage over traditional round- or flat-nose bullets. Let's unpack that advantage and take a closer look, using the two most popular lever-action rifle cartridges: .30-30 Winchester and .45-70 Gov't.

In those two cartridges, let's use Remington's Core-Lokt (CL) factory loads as examples of traditional, blunt-nosed bullets in lever-action ammunition.

Two CL options are available for the .30-30 Winchester: a 150-grain bullet with a G1 BC of .193, exiting the muzzle at 2,390 fps, and a 170-grain bullet with a BC of .254, exiting the muzzle at 2,200 fps.



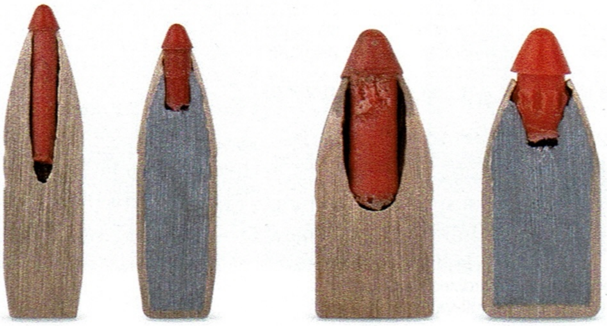
Shown are several popular .30-30 bullets. At right is a 170-grain flat-nose. Second from right is a 150-grain flat-nose. Third from right is Hornady's innovative Flex Tip 160-grain bullet with an aerodynamic-enhancing boattail and pointed tip. At left is Hornady's 140-grain MonoFlex, a homogeneous bullet. The lesser density of the copper alloy is obvious, as the 140-grain MonoFlex is longer than the 160-grain lead-core Flex Tip.

Several popular LEVERevolution cartridges, from left: .30-30 Win., .348 Win., .35 Rem., .444 Marlin, and .45-70

Let's compare those two loads to Hornady's 140-grain MonoFlex bullet with a BC of .295, exiting the muzzle at 2,465 fps, and 160-grain FTX bullet with a BC of .330, exiting at 2,400 fps.

On the following page is a chart showing retained velocity and energy at 100, 200, and 300 yards. As you can see, both of the pointed Hornady bullets equipped with the FTX tip hold velocity and energy considerably better than the flat-nose bullets. In fact, the 160-grain FTX has nearly twice the energy at 300 yards as the 150-grain CL.

If you adhere to the adage that 1,000 ft-lbs of kinetic



Sectioned bullets show the distinct difference between Flex Tip and MonoFlex bullets, as well as the similarities in their squishy tips. From left: 140-grain .30-caliber MonoFlex, 160-grain .30-caliber Flex Tip, 250-grain .458-caliber MonoFlex, and 325-grain .458-caliber Flex Tip.

.30-30 DROP & DRIFT

Distance	150-gr. CL Drop/Drift	170-gr. CL Drop/Drift	140-gr. MFX Drop/Drift	160-gr. FTX Drop/Drift
100 yds.	0/2.2 in.	0/1.9 in.	0/1.4 in.	0/1.3 in.
200 yds.	7.5/9.9 in.	8.2/8.1 in.	5.8/5.9 in.	6.1/5.4 in.
300 yds.	28.7/24.6 in.	29.8/19.7 in.	21.3/14.2 in.	21.7/13 in.

All numbers are calculated using standardized sea-level atmospheric conditions with a 10-mph full-value crosswind.

.30-30 VELOCITY & ENERGY

Distance	150-gr. CL fps/ft-lbs	170-gr. CL fps/ft-lbs	140-gr. MFX fps/ft-lbs	160-gr. FTX fps/ft-lbs
Muzzle	2,390/1,902	2,200/1,827	2,465/1,889	2,400/2,046
100 yds.	1,974/1,298	1,894/1,354	2,183/1,481	2,150/1,643
200 yds.	1,607/860	1,619/989	1,920/1,146	1,916/1,304
300 yds.	1,305/567	1,380/719	1,679/876	1,699/1,025

All numbers are calculated using standardized sea-level atmospheric conditions with a 10-mph full-value crosswind.

.45-70 VELOCITY & ENERGY

Distance	300-gr. CL fps/ft-lbs	250-gr. MFX fps/ft-lbs	325-gr. FTX fps/ft-lbs
Muzzle	1,900/2,405	2,025/2,276	2,050/3,032
100 yds.	1,575/1,652	1,616/1,450	1,729/2,158
200 yds.	1,305/1,134	1,286/918	1,450/1,516
300 yds.	1,111/822	1,071/636	1,225/1,083

All numbers are calculated using standardized sea-level atmospheric conditions with a 10-mph full-value crosswind.

.45-70 DROP & DRIFT

Distance	300-gr. CL Drop/Drift	250-gr. MFX Drop/Drift	325-gr. FTX Drop/Drift
100 yds.	0/2.8 in.	0/3.2 in.	0/2.4 in.
200 yds.	12.6/12.1 in.	12.1/14.3 in.	10.3/10.3. in.
300 yds.	45.8/28.6 in.	45.7/34.3 in.	37.4/24.7 in.
300 yds.	1,111/822	1,071/636	1,225/1,083

All numbers are calculated using standardized sea-level atmospheric conditions with a 10-mph full-value crosswind.

energy is the minimum needed to cleanly and consistently kill deer-size game, the 150-grain CL bullet is good to only about 150 yards and the 170-grain CL to about 200 yards. The 140-grain MonoFlex holds up to about 250 yards, and the 160-grain FTX has energy to spare at 300 yards.

How about a more tangible comparison, such as bullet drop and drift? At left is another chart showing those numbers, using the same .30-30 Winchester loads. As you can see, the flat-nose bullets have up to nearly double the wind drift and several inches more drop at 300 yards than the pointed FTX bullets.

The comparisons above are the most relevant on the lever-action hunting scene of all the cartridges we can consult because there are more .30-30s in the woods than all other lever-action cartridges combined. As you can see, Hornady's Flex Tip bullets make a considerable difference in every category; in some cases, they actually double potential performance capability.

However, the difference in performance isn't always so definable. Let's take a quick look at the .45-70 Gov't now, as it's the second most popular and common lever-action cartridge fielded by hunters.

In this case, the large diameter – nearly half an inch – of the bullets begins to negate the benefits of pointy bullets of useful weight. "Useful weight" is the key point here; if the .45-70 could effectively fire long, sleek, pointed bullets of 600 grains or so, being pointy would help more. But it can't, and a 325-grain,

LEVERevolution Cartridge & Bullet BC

Cartridge	Bullet (gr.)v	Muzzle Velocity (fps)	Bullet G1 BC
.25-35 Win.	110	2,425	.340
.30-30 Win.	140 MF	2,465	.295
.30-30 Win.	160 FTX	2,400	.330
.32 Win. Special	165 FTX	2,410	.310
.348 Win.	200 FTX	2,560	.320
.35 Rem.	200 FTX	2,225	.300
.444 Marlin	265 FTX	2,325	.225
.45-70 Gov't	250 MF	2,025	.175
.45-70 Gov't	325 FTX	2,050	.230
.450 Marlin	325 FTX	2,225	.230

All numbers are calculated using standardized sea-level atmospheric conditions with a 10-mph full-value crosswind.

.45-caliber, pointy bullet is still pretty blunt. As a result, the BC values of pointy .45-70 bullets aren't a significant step up from traditional round- and flat-nose .45-70 bullets.

Still, let's crunch some numbers. In the chart on the previous page, we stuck with Remington CL bullets for our traditional flat-nose type because they're ubiquitous and popular. In factory ammo, the 300-grain CL exits the muzzle at 1,900 fps and has a BC of .213.

We'll compare it to both Hornady bullets with FTX tips: the 250-grain MonoFlex with a BC of .175 (as you can see, quite low because of the large diameter combined with the light weight) that exits the muzzle at 2,025 fps and the 325-grain lead-core FTX, which has a better BC of .230 and exits the muzzle at 2,050 fps. It's faster than the monometal load because lead-core bullets are more malleable and are less likely to cause pressure spikes than monometal types, and out of respect for any vintage .45-70 rifles this ammo may be fired in, Hornady keeps internal pressure with its MonoFlex load moderate.

As you can see below, ballistic performance is more tied to muzzle velocity and bullet weight than it is to the flat-nose versus FTX tip in this case.

Now, there's one more area where Hornady's FTX bullets have provided a dual benefit for both lever-action shooters and hunters in states limited to using straight-wall cartridges. These squishy-tipped bullets provide better ballistics, more retained velocity and energy on impact, and more reliable bullet expansion on impact.

For example, the classic .444 Marlin has a cult-like following among straight-wall hunters, and Hornady's 265-grain FTX LEVERevolution offering boosts the .444's performance above all others. I won't force you to pore over a chart demonstrating its ballistic superiority to cartridges such as the .350 Legend, .360 Buckhammer, .450 Bushmaster, and so forth because this isn't an article about straight-wall cartridge performance. In short, it's as simple as this: Thanks to the 265-grain Flex Tip bullet at 2,325 fps, the .444 Marlin bests all other straight-wall contenders.

If you doubt me, run the numbers yourself: That particular bullet boasts a G1 BC of .225, higher than competing projectiles in most other straight-wall cartridges, and it exits the muzzle up to 300 fps faster. But I digress.

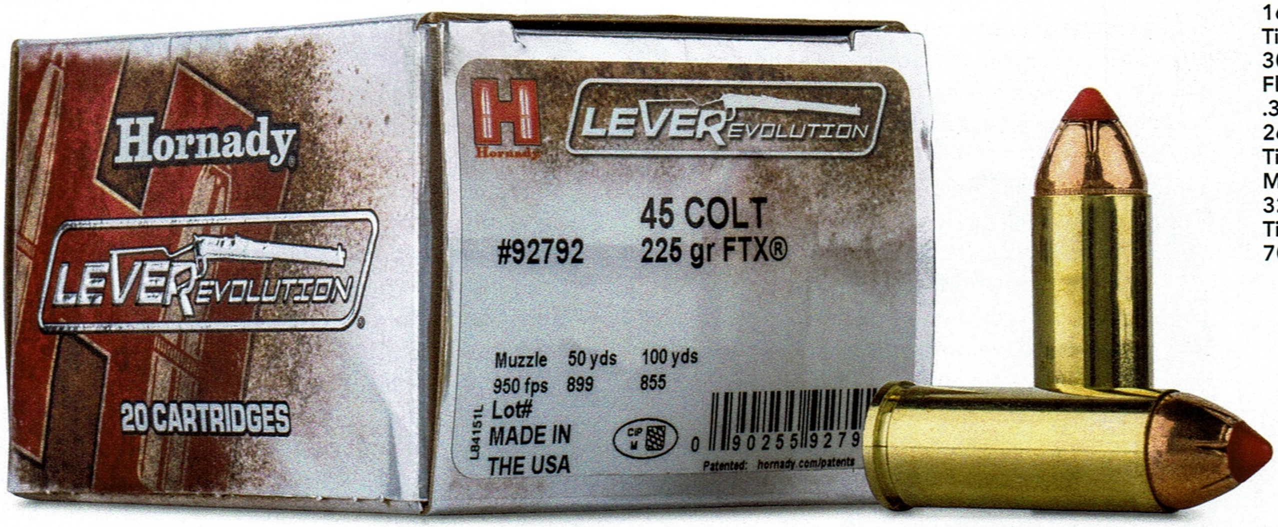
Conclusion

Perhaps the most telling factor in the success of the Flex Tip bullet and Hornady's LEVERevolution ammo line is the fact that nearly every introduction in the line is still humming successfully along. LEVERevolution offerings from .25-35 Winchester up to .45-70 Gov't are available at various online retailers and are often on local gun shop shelves.

If you're a lever-action lover who dotes on every aspect of classic tube-fed rifles except their limited range, choose to shoot LEVERevolution ammo loaded with Hornady's Flex Tip bullets. You'll be able to shoot farther, hit harder, and make the most of challenging shot opportunities otherwise outside the limit of your favorite lever gun.

Popular Flex Tip bullets, from left: 160-grain Flex Tip for the .30-30; 200-grain Flex Tip for the .35 Remington; 265-grain Flex Tip for the .444 Marlin, and 325-grain Flex Tip for the .45-70 Gov't.

LEVERevolution technology eventually extended into the revolver cartridge line, and rounds popular in revolver-caliber carbines were given Flex Tip bullets. These included .357 Magnum, .41 Magnum, .44 Magnum, and .45 Colt (shown).



6.5 Creedmoor Success

Winning the hearts and minds of shooters everywhere is no small feat.

By Dave Emary

Photos by Joseph von Benedikt and Mark Fingar

By now, we have all read at least 20 articles about how the 6.5 Creedmoor got its start. I won't tell you the story again. I would like to examine why this little cartridge has been so successful.

Twenty years ago, it was the rule that 6.5mm cartridges were just not accepted in the United States. The .264 Winchester Magnum had come and gone. The 6.5 Remington Magnum is virtually unheard of anymore. The .260 Remington has some following, but it's nowhere near the top of any lists.

The only 6.5mm cartridge that ever got much attention in this country was the 6.5x55mm, primarily because of the once inexpensive and well-made surplus Swedish Mausers. So why, in a short period of time, has a new 6.5mm cartridge taken the shooting world by storm, received a blizzard of press coverage, and been the chambering of choice for rifles and different types of ammunition from manufacturers? Let's explore what I think has led to this.

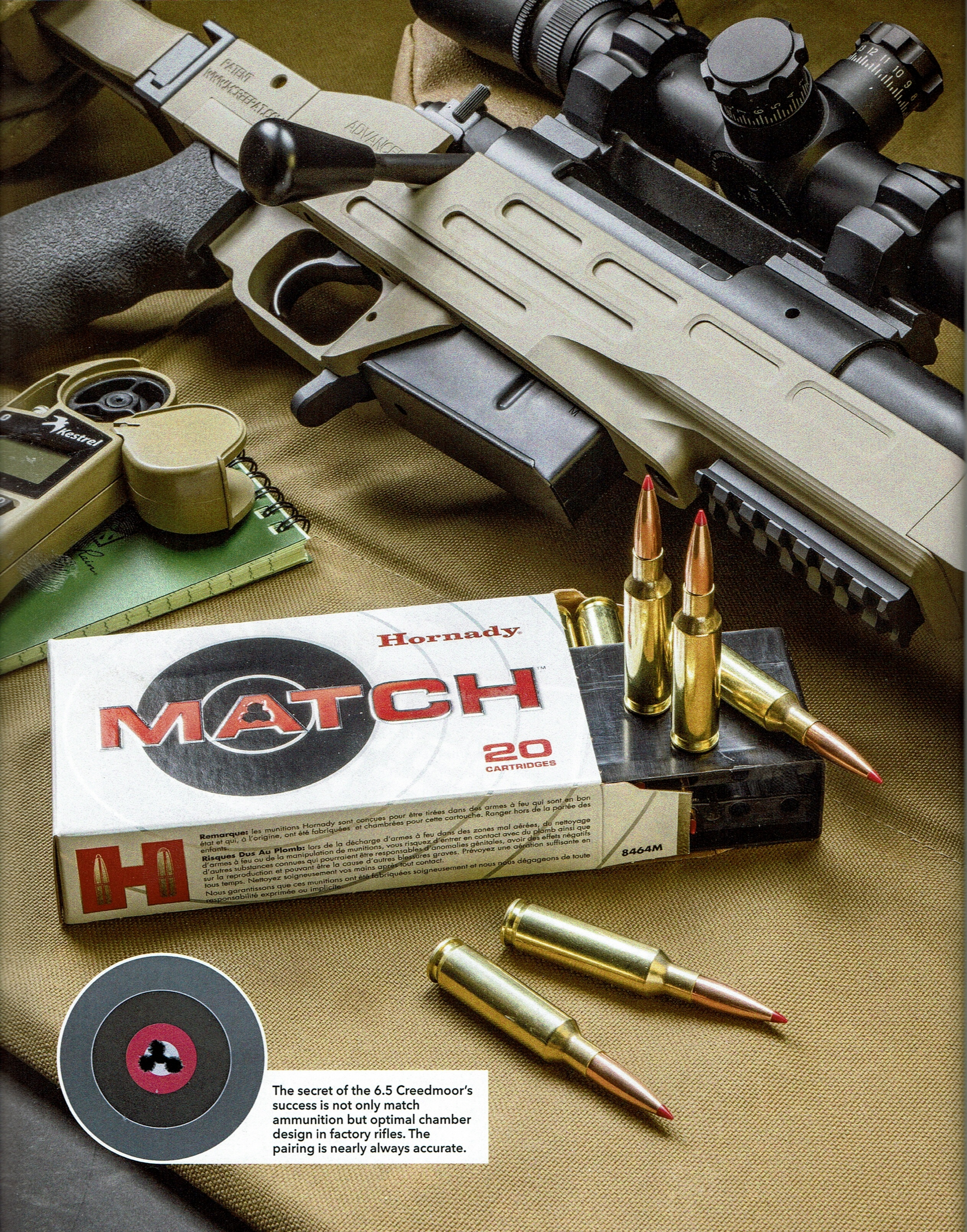
Production History

First off, let's discuss the history of the commercial development of the 6.5 Creedmoor. Hornady introduced the 6.5 Creedmoor in 2006 as an off-the-shelf match round that offered high levels of accuracy and had the load recipes printed right on the label. It was initially offered with a slightly downloaded, low recoil, 120-grain A-MAX match bullet for short-range, rapid-fire competitions and a full power, 140-grain A-MAX load for long-range competition. Both loads were accurate out of the box and easily shot well under 1 MOA from quality rifles.

Several upper-level shooters in High Power Rifle competed with the cartridge the first two years it was out and either won major competitions or were just behind the winner. It was beginning to get attention in the competition world. It had noticeably less recoil than the .308 Winchester, was more reliable than many of the hot loaded wildcats of that period, and offered high levels of accuracy along with good long-range ballistics. Ruger offered several rifle models, and DPMS offered an AR-10 rifle for 2006. However, it wasn't getting much notice from the general shooting public.

After the initial introduction, there were a number of discussions at Hornady about what a great hunting round the 6.5 Creedmoor would make. They usually ended up discussing how to convince the shooting public of the merits of the 6.5 Creedmoor and the 6.5mm caliber. The consensus was that if it was properly presented to the shooting public and factual performance information was presented to woo the shooters into using it as a hunting cartridge, it would take off. The ballistics of the cartridge for hunting generally exceeded other popular hunting cartridges such as the .308 Winchester, .30-'06 Springfield, and even the venerable .270 Winchester, especially at longer ranges. With high ballistic coefficient (BC) bullets launched at 2,700 to 2,800 fps velocities, the

PRECISION HUNTER™
20 CARTRIDGES
Hornady
6.5 CREEDMOOR



Remarque: les munitions Hornady sont conçues pour être tirées dans des armes à feu qui sont en bon état et qui, à l'origine, ont été fabriquées et chambrées pour cette cartouche. Ranger hors de la portée des enfants.

Risques Dus Au Plomb: lors de la décharge d'armes à feu dans des zones mal aérées, du nettoyage d'armes à feu ou de la manipulation de munitions, vous risquez d'entrer en contact avec du plomb ainsi que d'autres substances connues qui pourraient être responsables d'anomalies génitales, avoir des effets négatifs sur la reproduction et pouvant être la cause d'autres blessures graves. Prévoyez une aération suffisante en tous temps. Nettoyez soigneusement vos mains après tout contact.

Nous garantissons que ces munitions ont été fabriquées soigneusement et nous nous dégageons de toute responsabilité exprimée ou implicite.

The secret of the 6.5 Creedmoor's success is not only match ammunition but optimal chamber design in factory rifles. The pairing is nearly always accurate.

In the 6.5 Creedmoor, the ELD-X and ELD-M bullet designs deliver impressive performance for today's hunters and shooters.

Creedmoor was capable of flat trajectories and significantly less wind drift than available loads in these cartridges. The sleek bullets also resulted in high retained velocities and energy to what was considered long range. All this coupled with modest recoil made for an effective hunting cartridge that was pleasant to shoot even for young and recoil sensitive shooters.

In 2008, Hornady began offering the Creedmoor with the 129- and 140-grain tipped SST bullets and approached several of the prominent shooting publications and hunting TV shows to get press on the 6.5 Creedmoor as a hunting cartridge and show how good it was. Over the next two years, several more gun companies began offering hunting rifles chambered in the Creedmoor, and the little cartridge began to take off.

In 2010, Hornady offered the 6.5mm 120-grain monolithic copper GMX bullet in the Creedmoor. This load elevated the Creedmoor to having the capability to take on game into the elk class with an accurate, deep penetrating bullet. About this time, other ammunition manufacturers began to see the rapidly increasing popularity of the 6.5 Creedmoor, and over the next couple years, nearly every major ammunition manufacturer began offering loads for the 6.5 Creedmoor. By about 2012, the 6.5 Creedmoor was fully established as an effective and pleasant-to-shoot cartridge that was capable of both target shooting well beyond 1,000 yards and effectively taking game up to the size of elk beyond ranges that were traditionally considered long range.

In 2016, Hornady introduced the long-range ELD-X hunting bullet line that offered some of the highest BC hunting bullets available with a bullet and tip design that offered effective terminal performance to long hunting ranges. These bullets were also designed with quality control that gave them accuracy comparable to match bullets. The 6.5 143-grain ELD-X bullet at 2,700 fps in the 6.5 Creedmoor pushed the performance of the little cartridge into the realm of what would have previously been considered magnum hunting cartridge territory. It was here to stay.

Design Philosophy

There were three fundamental design criteria for this cartridge. The first was it would be extremely efficient, burning moderate charge weights of medium-speed propellants. This maximizes the performance of what would otherwise seem a rather small cartridge. This involves getting the case capacity that is well matched to the intended bullet weights in order to get the most from the propellant. You want to get the propellant to all burn before the bullet exits the muzzle. Otherwise, you are wasting energy.

The second goal was to design a cartridge/chamber along with the throat that would be inherently accurate. This was done by designing a minimum taper cartridge and chamber with a sharp shoulder along with a minimum clearance throat.

Lastly, they wanted to use new, heavier-for-the-caliber bullets that had high BCs, fast twist rates, and get the most out of the bullet for long-range performance. Joe Thielen at Hornady coined the phrase, "Let the bullet do the work." This is easy to understand.

A huge magnum shooting a low-BC bullet at high velocity is going to get passed by a high-BC bullet with modest velocity in the 400- to 500-yard range every time. This design philosophy has become the focus of most new cartridges and a lot of bullet designs since the early 2010s. Examples are the .224 Valkyrie, 6mm Creedmoor, 6mm ARC, 6.5 PRC, 6.8 Western, and 7mm PRC.

The best story I have for showing how this all comes together and how this cartridge punches above its weight comes from a hunt in South Africa in 2010. I

For most hunters chasing most game, the 6.5 Creedmoor is perhaps the most balanced cartridge ever designed.

Hornady's Precision Hunter rounds are match accurate and take down game with authority.

was fortunate to be sent by Hornady with a number of writers on a hunt for plains game featuring the 6.5 Creedmoor and the new 6.5mm 120-grain GMX bullet. My Professional Hunter (PH) asked what I was hunting with, and I showed him. His first comment was, "That's pretty small, mate. I don't know if you'll do well with that."

The first animal I took was a black wildebeest. We had crawled about 1,000 meters to get up on them. We were in some rocks, and a nice bull was 315-yards away. There was a 15 to 20 mph full value crosswind at the time. He asked me if I could hit it.

"Where do you want me to hit it?" I asked.

"Right behind his shoulder," he said. "Don't get too low."

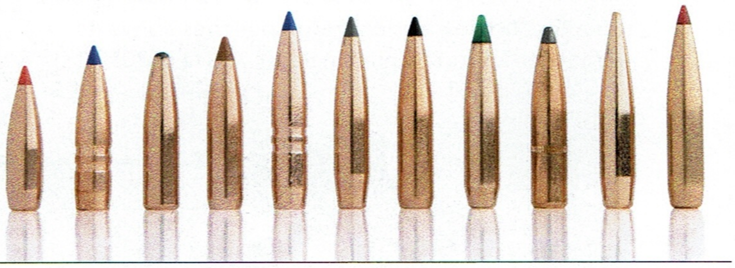
I figured my wind hold-off, dialed the come-up, and took the shot. It was a perfect lung shot and visibly blew lungs out the other side.

The PH jumped up and said, "Bloody hell, that was a good shot!" He didn't question the Creedmoor anymore. On that hunt, I also racked up two kudu, one at 420 yards, and several writers took Zebras. There were only a couple of the GMX bullets recovered. Nearly all of them exited the animal.

Performance Specifics

So, let's look at some performance comparisons of factory offerings of hunting loads in several popular calibers with the 6.5 Creedmoor included. I compared calculated recoil with these loads based on a 9-pound rifle and scope. I compared drop, retained velocity and energy, and wind drift at 500 yards with a 200-yard zero and recoil energy. I used published numbers from the representative companies for muzzle velocity and BC. I calculated all trajectories and recoil using the jbmballistics.com solver. For the comparison, I used the Hornady 6.5 Creedmoor 143-grain ELD-X load, Remington Premier Long Range .270 Winchester 150-grain load with a 150-grain Speer Impact bullet, Federal .308 Winchester 175-grain Terminal Ascent, and Federal 30-'06 175-grain Terminal Ascent loads. For recoil calculations, I used charge weights from the Hornady reloading manual with powders that are standbys for the cartridges. All the loads from these companies represent the same class of bullets that are all competing head-to-head for the long-range hunting market. The goal is to show how well the 6.5 Creedmoor competes even with the latest bullets and loads.

From the performance table, you can see the 6.5 Creedmoor compares extremely well with the other cartridges. The 6.5 Creedmoor has 20 to 38 percent less recoil than any of the other loads yet offers nearly the flattest trajectory to 500 yards, the least wind drift, and nearly the highest retained velocity with retained energy in the same category as the other three. Remember also that, because



With the 6.5 Creedmoor, reloaders can use bullet weights ranging from 80 grains all the way to the excellent 153-grain A-TIP, which results in extraordinary versatility for hunters and shooters.

Cartridge Performance Comparison

Published BC	Published BC	Velocity (fps)	Charge Weight (gr.)	Recoil Energy (ft-lbs)	Drop (in.)	Drift (in.)	Retained Velocity @ 500 yds. (fps)	Retained Energy @ 500 yds. (ft-lbs)
6.5 Creedmoor 143 gr.	.625	2,700	42	12	44.4	15.4	2,018	1,293
.270 Winchester 150 gr.	.542	2,850	56	16.8	41.5	16.8	2,044	1,393
.308 Winchester 175 gr.	.520	2,600	42	15	47.3	18.8	1,901	1,348
.30-'06 Springfield 175 gr.	.520	2,730	56	19.3	46.3	18.7	1,919	1,430

of the large BC advantage the 6.5 Creedmoor has, it will outpace the other three for drop, drift, retained velocity, and energy as the range is extended beyond 500 yards. All of these hunting bullets have about the same threshold velocity for expansion of about 1,700 fps. The 6.5 Creedmoor would offer expansion at the greatest distance of any of these loads.

In short, the 6.5 Creedmoor offers outstanding performance, especially at distance, and well beyond what its size would suggest. It also does it much more comfortably than a lot of other similar cartridges. Couple this with a cartridge and chambering known for high levels of accuracy out of the box, and this all goes together to explain its current popularity.

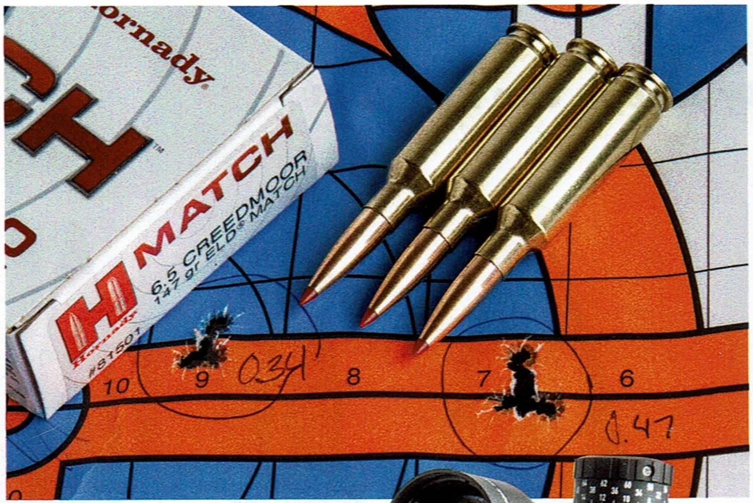
Concluding Thoughts

The design philosophy and resulting performance of the 6.5 Creedmoor has put this little cartridge in the highest echelons of all-around, versatile, high-performance cartridges available today. It is truly capable of functioning as a high-level, crossover cartridge across match competition, PRS, long-range shooting, and hunting. It performs well in all these disciplines. With some of the newest, extremely high-BC bullets like the 153-grain Hornady A-TIP, the 6.5 Creedmoor is supersonic to over 1,500 yards at sea level.

In my opinion, the 6.5 Creedmoor ended the era of cartridge design philosophy of, "You have to go fast to succeed. Put a lightweight bullet with low BC in a huge case and make it go fast." This works fine for 300- to 400-yard shooting but rapidly falls behind after that. This approach also produces excessive recoil and noise because of how inefficient it is.

The 6.5 Creedmoor also started the current trend in cartridge and bullet designs of paying attention to the bullet aerodynamics, getting the highest BC feasible, and designing a cartridge and throat that gets the bullet out of the body of the cartridge case. This type of design has shown to offer accuracy advantages because of less chance of distortion to the bullet while exiting the case and engaging the rifling with less pitch and yaw.

If you haven't tried the 6.5 Creedmoor yet, you should. You will be pleased with the shootability of it and the results you get. **H**



Another advantage of the 6.5 Creedmoor is how well it works in the popular AR-10. Ballistically, the 6.5 Creedmoor crushes the .308, which has long been the standard chambering for large-frame ARs.

New Cartridge Introductions

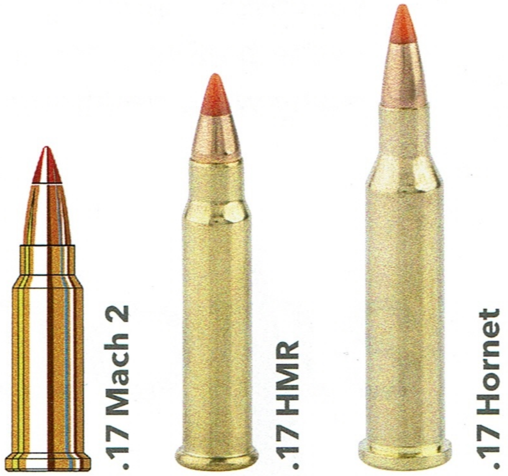
Let the record show that Hornady has introduced the best precision hunting cartridges of all time.

By Joseph von Benedikt

Here's a fun question: Of the many successful cartridges introduced in the past quarter-century, how many were designed by Hornady?

The answer? Astonishingly, nearly all of them. From the .204 Ruger to the .300 PRC and even up to the .375 and .416 Ruger (the only successful big-bore cartridge introductions since 1989), almost all the fast, potent hunting cartridges that have achieved widespread popularity were engineered by Hornady.

LEVER EVOLUTION
Hornady
AMMUNITION
20 CARTRIDGES
308 Marlin Express
160 gr Evolution



Hornady has provided lever-action shooters with a variety of hard hitting, revolutionary cartridges for many years.

I don't want to throw any cartridges under the recycling bus, but just consider rounds that could have done well: the .224 Valkyrie, the .327 Federal, the 26, 27, 30, and 33 Nosler cartridges, and so forth. They were not designed by Hornady, and for various reasons – usually to do with some design characteristic – they all failed.

So, what gives? A quarter century ago, Hornady came to the game with singular focus on creating new cartridges that provide shooters with unprecedented performance and made a point of engineering cartridge designs as flawless as geniuses and computer programs could make them.

Perhaps most importantly of all, Hornady understands that modern shooters appreciate efficiency, consistency, and aerodynamics. Balance is key.

Hornady hired the best cartridge and ballistic engineering minds in the industry who in turn hired more incredibly bright minds. Trained by masters and tuned by application, those smart people evolved into the finest cartridge design team ever assembled. They honed their craft on projects such as the .204 Ruger and .17 HMR – both household names today – and eventually created a precision-shooting cartridge lineup that would be Hornady's magnum opus: the Creedmoor and PRC cartridges.

Now, not all Hornady's designs rose to greatness. Some were a bit too little of a good thing; in my opinion, the .30 T/C falls into this category. The .300 and .338 Marlin Express were potent lever-action cartridges but fell by the wayside because Marlin Firearms faltered. The short, fat RCMs were conceptually great but Johnny-too-late.

It's not a perfect track record, but it's more perfect than any other quarter-century history of its type.

Let's start at the bottom with the petite-but-peppy .17 rimfires and look at Hornady's various cartridges all the way up through the .416 Ruger.

.17 HMR (and .17 Mach 2)

Introduced in 2002, the .17 HMR (Hornady Magnum Rimfire) is a sizzling-fast cartridge ideal for shooting varmints. Created by necking .22 Magnum cases down to hold .17-caliber projectiles, it's got at least three times the effective range of the popular .22 Long Rifle cartridge, and terminal impact is equally impressive. Two projectile weights are common: a 17-grain bullet at 2,650 fps and a 20-grain pill at 2,350 fps. Because it's a higher-pressure cartridge than the .22LR, the .17 HMR is commonly problematic in blowback-type semiauto designs, but in an accurate bolt action, it is shockingly good.

Because its origin story is similar, we're lumping the .17 HM2 (Hornady Mach 2) cartridge with the .17 HMR. The HM2 was introduced in 2004 and features a .22LR Stinger case necked down to .17. It pushes 17-grain bullets at 2,100 fps and was conceived to function in semiauto firearms. It's a good cartridge but was lost in the shadow of the more powerful .17 HMR.

.17 Hornet

This cartridge of petite perfection was originally created by legend P.O. Ackley in the '50s by necking down the .22 Hornet to hold .17-caliber bullets. Hornady finessed dimensions a bit to optimize performance and legitimized it six decades later. For its tiny size, the .17 Hornet is surprisingly potent; it pushes 20-grain bullets at 3,650 fps.

.204 Ruger

6mm ARC

6mm Creedmoor

.204 Ruger

Created by necking down .222 Remington Magnum cases to hold .20-caliber (.204 inch) bullets, the .204 Ruger is fast, flat-shooting, and recoils little. It vaulted to stardom almost immediately and remains a favorite among high-volume varmint shooters and fur hunters who appreciate tiny holes in pelts. Several bullets are available: 32-grainers exit the muzzle at 4,225 fps, 40-grain bullets at 3,900 fps, and 45-grain projectiles achieve 3,625 fps.

6mm ARC

Conceived as the ultimate all-purpose cartridge for AR-15s, the 6mm ARC (Advanced Rifle Cartridge) was introduced in 2020. Created by shortening and reshaping the .220 Russian case in similar fashion to the 6.5 Grendel, the ARC pushes relatively high-BC bullets of 103 to 108 grains at 2,750 to 2,800 fps. Thanks to low aerodynamic drag, these projectiles maintain supersonic velocities to eyebrow-raising distance, and the cartridge has proved to be startlingly effective in both AR-15s and in PRS-type competitive shooting.

6mm Creedmoor

Although it was officially born in 2017, the 6mm Creedmoor was turning heads and placing in national-level competition well before that. Originated by George Gardner, who built a rifle for *Outdoor Life* editor John Snow for an article on wildcats, it's created by necking down 6.5 Creedmoor cases, and its forte is heavy-for-caliber bullets of more than 100 grains, which it pushes to about 3,000 fps. Those heavy bullets are where it differentiates itself from the classic .243 Winchester. In the decade or so since it became popular, the 6mm Creedmoor has won and placed in several PRS national championships. It's also one of the finest long-range predator cartridges ever spawned.

6.5 Creedmoor

6.5 Creedmoor

Introduced in 2008, the "Creed" had a slow start but would become the most influential cartridge in America since the .30-'06 debuted more than a century earlier.

Conceived by Hornady's cartridge mastermind Dave Emary with desired performance characteristics outlined by world champion long-range shooter Dennis DeMille, the 6.5 Creedmoor was intended to be the ultimate off-the-shelf 600-yard competition cartridge. It was created by necking down the .30 T/C. The Creedmoor is at its best with 6.5mm (.264 inch) bullets of 130 to 150 grains. With these, it generates from 2,600 fps to 2,800 fps. Over time, the 6.5 Creedmoor has proved to be one of the most inherently accurate cartridges of all time, and it is easy to shoot thanks to low recoil and high bullet aerodynamics. It's quite the hunting cartridge as well.

6.5 PRC

6.5 PRC

Although still young, the 6.5 PRC (Precision Rifle Cartridge) is the phenomenon that showed the industry how ready American shooters and hunters are for exactly this type of cartridge. Unlike its little Creedmoor sibling, the 6.5 PRC did not have a slow start; it rose to popularity at unprecedented speed.

The 6.5 PRC is as good a deer cartridge as has ever been invented. It spits highly aerodynamic 6.5mm (.264) bullets of 140 grains at nearly 3,000 fps and heavier, 147-grain bullets in excess of 2,900 fps. Overall length is a bit more than a traditional short action; still, the 6.5 PRC fits into and feeds from a 2.960-inch magazine box, so it can be built on a compact rifle.

Many serious hunters agree that although the 6.5 PRC does not have the extreme barrel life of the 6.5 Creedmoor, it has a discernible edge in the hunting field.

7mm PRC

7mm PRC

The latest of Hornady's extraordinary series of Precision Rifle Cartridges, this 7mm is also the most versatile. Of the three PRCs (6.5mm, 7mm, and .300 caliber), this pushes bullets with the sleekest drag coefficient the fastest. Proponents point out that the 7mm PRC has much more elk-clobbering authority than the 6.5s and much less shooter-clobbering recoil than the .300 PRC.

Is it better than the classic 7mm Rem. Mag.? The answer isn't simple, but it's an unequivocal "yes." Factors that give the 7mm PRC an edge are its ultimate compatibility with the best long-range 7mm projectiles available (a function of fast twist rate and plentiful cartridge head height) and its inherent efficiency and consistency. Hornady's engineers have had considerable practice in perfecting the precision rifle cartridge (see what I did there?), and they got it right with the 7mm PRC.

.308 Marlin Express

Introduced in 2007 in a joint project by Hornady and Marlin, this cartridge produces the most velocity of any big-game cartridge designed for lever guns with tubular magazines. The 160-grain FTX bullets exit the muzzle at 2,660 fps, ballistically matching the .308 Winchester.

Unfortunately, Marlin Firearms went through a series of sales and relocations that nearly destroyed the company, and the cartridge wasn't supported by firearms chambered for it. As a result, the .308 Marlin Express never had a chance.

.30 Thompson Center (.30 T/C)

The biggest whitetail buck I've ever seen on the ground was taken with a .30 T/C, and for that reason alone, the cartridge stands out in my mind. The boundary-pushing cartridge's case was a tad shorter than the .308 and much shorter than the .30-'06, but with medium-light bullets, it produced higher velocity than either.

Unfortunately, the cartridge itself was a bit ahead of its time, and its efficiency, its compatibility with long, sleek bullets, and its increased velocity via double-based, high-energy propellants was lost on the hunting public. Today, it's virtually unknown; its only real claim to fame being that it's the parent case for the 6.5 Creedmoor.

.300 RCM

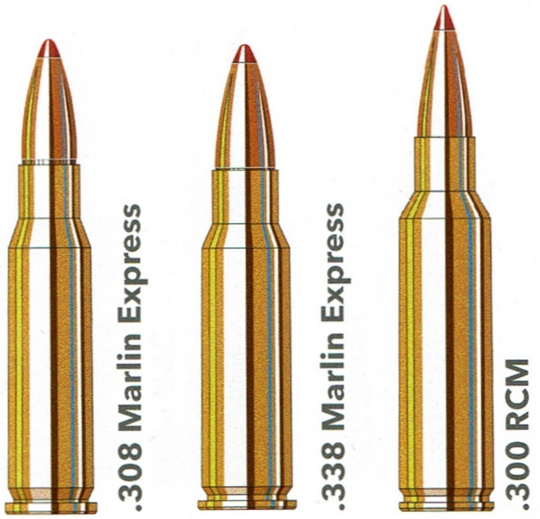
Conceptually, the .300 RCM (Ruger Compact Magnum) cartridge was genius: It's intended to produce traditional .30-caliber magnum velocities in a short-action rifle with a 20-inch barrel.

It nearly achieved that criterion, too. Certainly, it was close enough that few hunters and no deer or elk alive could find a practical difference. Unfortunately, the RCMs were launched in the dust of Winchester's WSM cartridges and Remington's SAUM cartridges, and few hunters gave them a second look.

Were the RCMs launched today, they would have a better chance, because they're outstanding for use with a suppressor – something that modern shooters value much more now than they did 15 years ago.

.300 PRC

Ahhh, the western big-game hunter's long-range dream cartridge. Many elk guides I know carry suppressed rifles chambered in .300 PRC. Why? Because with a good suppressor, they recoil lightly but absolutely wallop big bulls downrange. Clients with guns that won't shoot are offered the guide's custom rifle. Finding it easy to shoot and easy to hit faraway targets with, they cheerfully accept it and go kill big bulls with spectacular effect.



In factory ammo, the .300 PRC pushes 190-grain monometal CX bullets at 3,000 fps, 212-grain ELD-X bullets at 2,860 fps, and super-aerodynamic 225-grain ELD Match bullets at 2,810 fps. I've made my longest consistently effective shots on steel targets with 250-grain Hornady A-TIP bullets loaded in .300 PRC cartridges. Whether shooting factory loads or handloaded ammo, the .300 PRC is the most advanced, cutting-edge magnum .30 available without debate.

.338 Marlin Express

Like its smaller .30-caliber sibling, the .338 MX was designed to provide an increase in performance in tube-fed lever-actions. It did so effectively: 200-grain bullets exit the barrel at 2,560 fps. That's great medicine for hunting timber country for elk and deer.

Unfortunately, also like the .308 MX, this fine medium .338 died almost before it lived, as Marlin Firearms languished under ownership changes and relocations.

.338 RCM

As the last of the flurry of short, fat magnums introduced like dominoes by various competing ammo companies, the .338 Ruger Compact Magnum (theoretically) was behind the times. However, in terms of performance, it stood out and, in this one man's opinion, was arguably the one that most deserved to succeed. It's designed to fit into short, fast-functioning actions and generate good velocity in short, 20-inch barrels with .338 bullets. I always figured it's the ultimate bear cartridge for a fast-handling bolt-action.

Chunky 225-grain bullets exit the muzzle at 2,750 fps, nearly matching the legendary .338 Win. Mag.

.375 Ruger

.416 Ruger

From innovative rimfires to long-range heavy hitters, Hornady has been the leader in cartridge development in recent decades.

Lighter bullets can be handloaded to fast velocities; heavier 250-grain bullets aren't compatible with the cartridge due to its short length.

.375 Ruger

Introduced in 2007, nearly a century after the legendary .375 Holland & Holland, the .375 Ruger is only the second .375-caliber cartridge in history to achieve widespread acceptance. Several others tried; all failed. Launched as a joint project in Ruger's controlled-feed, Mauser-based M77 bolt-action rifles, the .375 Ruger is a bit faster than the .375 H&H and fits into .30-'06-length actions rather than requiring a magnum-length action. Heavy, deep-penetrating 300-grain bullets exit the muzzle at 2,660 fps. Lighter projectiles of 270 grains achieve 2,840 fps.

The .375 Ruger took root in Alaska, where grizzly bear and moose hunters relish the heavy-hitting cartridge's sledgehammer-like effect. Ruger made a point of designing stainless-steel, synthetic-stocked, iron-sighted M77 rifles specifically tailored to use in the rugged, wet environs of the Far North and sells them for far less cost than most rifles chambered in .375 H&H. As a result, the .375 Ruger became a household name in the Far North.

.416 Ruger

Announced in 2008, just a year after the successful launch of the .375 Ruger, the .416 version is the most modern big-bore bolt-action cartridge available. It pushes 400-grain bullets at an impressive 2,400 fps yet comfortably fits into sleek .30-'06-length actions. It's not as good at extended distances as its .375-diameter sibling, but for use on African game from Cape buffalo to elephant and on coastal brown bears, it hits considerably harder.

Dangerous-game guides in coastal Alaska quickly became partial to the .416 Ruger, and hunters heading to the Dark Continent to hunt the biggest, gnarliest dangerous game adopted it wholeheartedly.

.450 Bushmaster

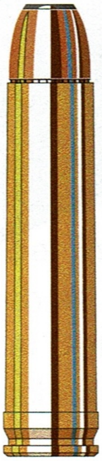
At Bushmaster's request, Hornady engineered the .450 Bushmaster to provide heavy-hitting capability in AR-15 firearms, but that's not where the cartridge rooted and flourished. Rather, it was eagerly adopted by whitetail hunters in states restricted to using straight-wall rifle cartridges. Bullet diameter is .452, like the .45 Colt and .45 Auto. Wide, polymer-nosed bullets of 250 grains exit the muzzle in excess of 2,200 fps. Inside 200 yards, the Bushmaster absolutely clobbers big bucks. The cartridge recoils impressively, but proponents believe the downrange effect of the cartridge is well worth that cost.

AR-15s in .450 Bushmaster can be had, and compact, inexpensive bolt-action rifles chambered for the cartridge are plentiful.

.450 Marlin

Made to provide substantially higher velocity than the grand old .45-70 Gov't, the .450 Marlin utilizes a .458 Win. Mag.-type case shortened and with a wider belt. It pushes 325-grain bullets at 2,225 fps, 350-grainers at 2,100 fps, and 400-grain bullets at nearly 2,000 fps. Introduced in the year 2000, it managed to hang on when Marlin stopped building M1895 rifles chambered for it around 2009. Currently, Browning's BLR and Ruger's No. 1 can be found chambered for the .450 Marlin, and with any luck, under Ruger's ownership, the reborn Marlin Firearms Company will again chamber the cartridge in its excellent lever-actions.

.450 Bushmaster



.450 Marlin

AMERICAN MADE
MILITARY GRADE
FRONTIER
CARTRIDGE
LOADED WITH HORNADY® BULLETS
50 CARTRIDGES
MILITARY GRADE
AMERICAN MADE
FRONTIER
CARTRIDGE
223 REM
55 gr FMJ
50 ROUNDS
MV 3240 fps
Item # FR1005
LOADED WITH HORNADY® BULLETS
FRONTIER®
CARTRIDGE
MADE IN THE USA

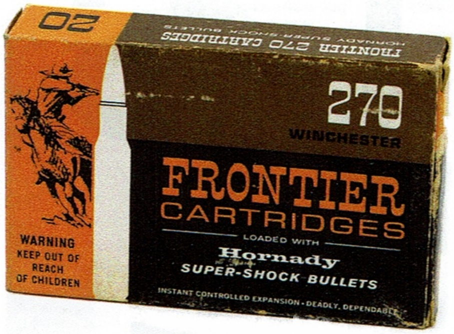
What's in a Name?

FRONTIER
223 REM

The story of Hornady's Frontier brand of ammunition.

By Dave Emary

Considering what it is today, few of us would guess the humble beginnings of Hornady ammunition. Hornady has been an industry leader in premium ammo innovation for the last 20 years with products such as the .17 HMR, .204 Ruger, LEVERevolution, Critical Defense, Critical Duty, Superformance, and Precision Hunter, just to name a few. (Full disclosure: I retired from Hornady in 2017.)


20
FRONTIER 270 CARTRIDGES
HORNADY SUPER-SHOCK BULLETS
270
WINCHESTER
FRONTIER
CARTRIDGES
LOADED WITH
Hornady
SUPER-SHOCK BULLETS
INSTANT CONTROLLED EXPANSION · DEADLY, DEPENDABLE
WARNING
KEEP OUT OF REACH OF CHILDREN

Hornady Frontier packaging circa 1969 to 1972.

FRONTIER CARTRIDGES
20
Hornady's
FRONTIER
CARTRIDGES
Loaded with
HORNADY
SUPER-SHOCK BULLETS
Deadly - Dependable
WARNING
Keep out of reach of children
Hornady's
FRONTIER
CARTRIDGES
RIFLE
Full M
Hornady's
FRONTIER
CARTRIDGES
RIFLE
20
220
60
Hollow Po

Hornady Frontier packaging circa 1972 to 1984.

Frontier's Past

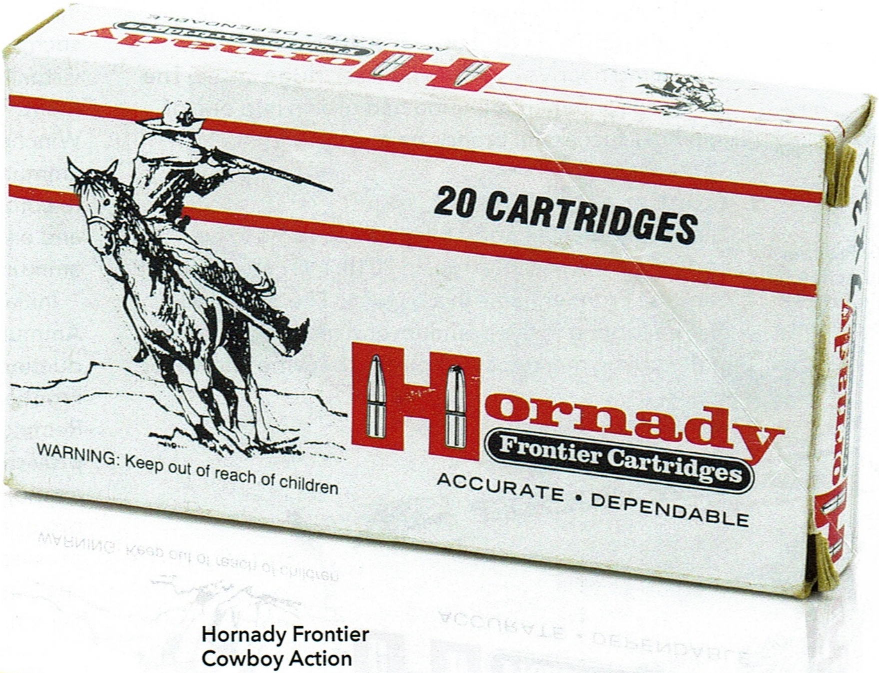
Hornady's entry into the ammo world in 1964 was far more inauspicious than what the company currently has to offer. In 1949, Joyce Hornady started Hornady Manufacturing to answer the need for accurate bullets for demanding shooters. The company quickly garnered a reputation for producing accurate and dependable hunting and varmint bullets.

Hornady was well established in the shooting and reloading world by 1964, so Joyce made the decision to bring the company into the ammunition world. He was up against very stiff competition from the Big Three: Federal, Remington, and Winchester. He gambled that Hornady's high-quality and accurate bullets would sell in loaded ammo.

In the early 1960s, the U.S. was ramping up its involvement in Vietnam, and the Cold War was at its peak. To support U.S. requirements and allies around the world, production of military small-arms ammunition was at a high. At the time, the .45 ACP was still the standard-bearer military handgun caliber of the U.S. The 7.62 NATO (.308 Winchester) was still relatively new to the military but was already in the process of being replaced by the new 5.56 NATO (.223 Remington).

The .30-'06 Springfield and .30 Carbine were being produced in large quantities to supply the still-in-service M1 Garands and M1 Carbines of the South Vietnamese army and other countries. It's no wonder that Hornady's first offerings in '64 were military-surplus cartridge cases loaded with Hornady bullets. They initially included the .30 Carbine, .308 Win., and .30-'06 Springfield. Joyce chose to name his new ammunition line "Frontier."

The Frontier line of cartridges slowly began to grow. They also added other popular commercial ammunition of the time. Hornady sourced cartridge cases for their commercial rounds from other ammo industry companies. These cartridge cases carried the Frontier



Hornady Frontier Cowboy Action packaging circa 1984 to 2002.

headstamp. By 1972, the Frontier line of ammo had grown to include the 9mm Luger, .38 Special, .222 Rem., .22-250 Rem., .243 Win., .270 Win., 7mm Remington Magnum, .30 Carbine, .30-30 Win., .308 Win., and .30-'06 Springfield.

Frontier ammunition continued to grow through the 1970s and '80s as more and more calibers were added to the Hornady line. Cartridge cases continued to be sourced from outside suppliers and headstamped with the Frontier name. In the late 1980s, Hornady assumed responsibility for its first industry-standardized Sporting Arms and Ammunition Manufacturers' Institute (SAAMI) cartridges with the 10mm Auto and .220 Swift.

The long and short of the story is by being the company responsible for standardizing and introducing a new cartridge to SAAMI, there also came a responsibility to the industry to provide the standards and specifications for the cartridge. This included chamber specifications as well as reference and proof ammunition.

In the early 1990s, Hornady began to produce small quantities of its own cartridge cases, and in-house production of their cartridges made up a small fraction of what was being loaded into ammo every year. At the time, all locally produced cartridge cases bore the "HORNADY" headstamp, and each cartridge case sourced outside the company retained the "FRONTIER" headstamp. This was done so that the source of the cartridge case could quickly be identified. But by the mid-to-late 2000s, customers were beginning to be confused by the sourcing of Hornady ammo because it was being loaded with two different headstamps. They wondered if there were differences between the Frontier and Hornady headstamped ammo. Through the early to mid-2000s, Hornady continued to produce more and more of their own cartridge cases using the Hornady headstamp.

In 2009, the decision was made to have all cartridge cases, no matter the source, headstamped with HORNADY. The 2009 decision marked the end of the "Frontier" name, with the exception of Hornady's Cowboy Action loads. By early 2010, Hornady was producing nearly all of their own cartridge cases. The humble Frontier ammunition had grown into one of the most successful brands on the market.

Frontier at the Present

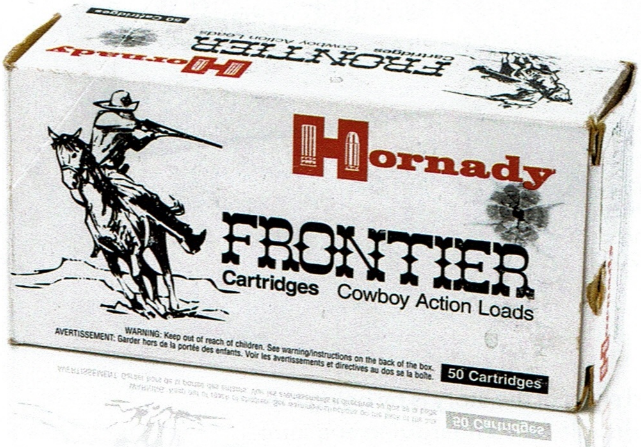
The saying that "all good things must come to an end" is not necessarily true. In 2018, Hornady brought back the Frontier name in a big way. The brand was on firm footing in the premium and niche segments of the ammo market, and Hornady became known for innovative and high-performance bullets and ammo, such as the new ELD family. However, Hornady had virtually no presence in the lower price-point segment. This was the domain of Federal, Remington, and Winchester, all of whom have high-volume, low-cost ammunition lines. In 2016, Hornady made the decision to compete in the Big Three's price-point category and entered by reintroducing its Frontier line of ammunition.

Initially, Hornady teamed up with Lake City Army Ammunition Plant (LCAAP) to use their excess production capacity for production of Hornady's line of Frontier-branded ammo. Loads were offered in .223 Remington, 5.56 NATO, and .300 Blackout. Hornady provided the projectiles to LCAAP for loading Frontier ammo rather than the standard military M855 or M856 projectiles. The teaming arrangement with LCAAP provided ammunition loaded with high-strength mil-spec cartridge cases and crimped primers along with mil-spec propellants.

Hornady now loads Frontier in-house, offering production-equivalent versions of the M193 55-grain full metal jacket (FMJ) and M855 62-grain FMJ. Hornady also offers a large range of bullet weights and styles to cover just about anything you'd want to do with an AR-15 from varminting to plinking to law enforcement training. Bullet styles are available in FMJ, hollowpoint (HP), soft point (SP), and boattail hollowpoint (BTHP) match. Offered bullet weights in the 5.56 range from 55 to 75 grains, and .223 Rem. loads range from 55 to 68 grains. The .300 Blackout is offered with a 125-grain FMJ bullet.

All bullets are manufactured by Hornady with their usual high standards for quality and accuracy. It will be difficult to find another line of ammo at this price point that matches Frontier's quality and range of bullet weights and styles. Here, a short discussion of the difference between 5.56 NATO and .223 Rem. is in order. The 5.56 NATO

Hornady Frontier Cowboy Action packaging circa 2002 to present.



AMERICAN MADE
MILITARY GRADE
FRONTIER
CARTRIDGE
UN0012, CARTRIDGES, SMALL ARMS 1.4S
5.56 NATO
55 gr HP
420 Cartridges
#FR640

Frontier is packaged in a variety of box sizes and counts. Many of the offerings come in 20, 150, 500, and 1,000-round options.

"All bullets are manufactured by Hornady with their usual high standards for quality and accuracy."

came first, and the .223 Rem. was a commercialized 5.56 round with a redesigned throat and freebore in order to produce better accuracy for a commercial cartridge. The 5.56 has a longer and larger-diameter throat and freebore that allows the projectile to jump farther to the rifling. The 5.56 also operates at higher pressure than the .223.

The .223 has a smaller diameter and shorter throat and freebore with less jump to the rifling than the 5.56, which gives the .223 an edge in accuracy. Because of these differences in the throat and freebore, you should not fire 5.56 NATO in a .223 Rem. chamber. This will cause elevated pressures that can pierce primers and damage your firearm. It is safe to fire .223 in the 5.56 because the longer throat of the 5.56 causes a pressure and velocity drop.

Another significant difference in the two is that the 5.56 uses a 20-inch pressure- and velocity-test barrel as opposed to the 24-inch test barrel used for the .223 Rem. This is why you may see lower velocities listed for 5.56 with the same bullet weight as the .223 despite the 5.56's higher operating pressure. Velocities listed are from the standard-length test barrels.

FRONTIER
CARTRIDGE
LOADED WITH HORNADY BULLETS
50 CARTRIDGES
223 REM
55 gr HP
50 ROUNDS
MV 3240 fps
Item # FR1405
LOADED WITH HORNADY BULLETS

FRONTIER
CARTRIDGE
LOADED WITH HORNADY BULLETS
150 CARTRIDGES
AMERICAN MADE
MILITARY GRADE
223 REM
55 gr SPIRE POINT
150 ROUNDS
MV 3240 fps
Item # FR1215
MADE IN THE USA
LOADED WITH HORNADY BULLETS

At the Range

For this article, I tested Frontier 5.56 NATO loadings with the 55-grain FMJ, 62-grain FMJ, and 68-grain BTHP Match. I fired five five-shot groups at 100 yards with each load through a Windham Weaponry 16-inch M4-style carbine and a 4X optic. All loads functioned flawlessly and had ejection patterns that were consistent. All spent cases dropped within a small area. The 55-grain FMJ load did not seem to like the fast 1:8-inch barrel twist. I found the 62-grain FMJ and 68-grain BTHP match loads to be reasonably accurate. They were significantly more accurate than what I have come to expect from M855 and M193 ammo and knockoffs through my gun. The new Frontier line should have a load that will satisfy most shooters' needs in a low-cost round for just about any application and AR-15 configuration.

The Future

As good as the Hornady Frontier line of ammo is, I would look for it to continue to expand and include new bullet weights in each caliber. For those of us who are 7.62 fans, wouldn't it be nice to have a .308 Win. load that was of higher quality and produced better accuracy than the M80 Ball round? And maybe match and hunting-style offerings at very competitive prices?

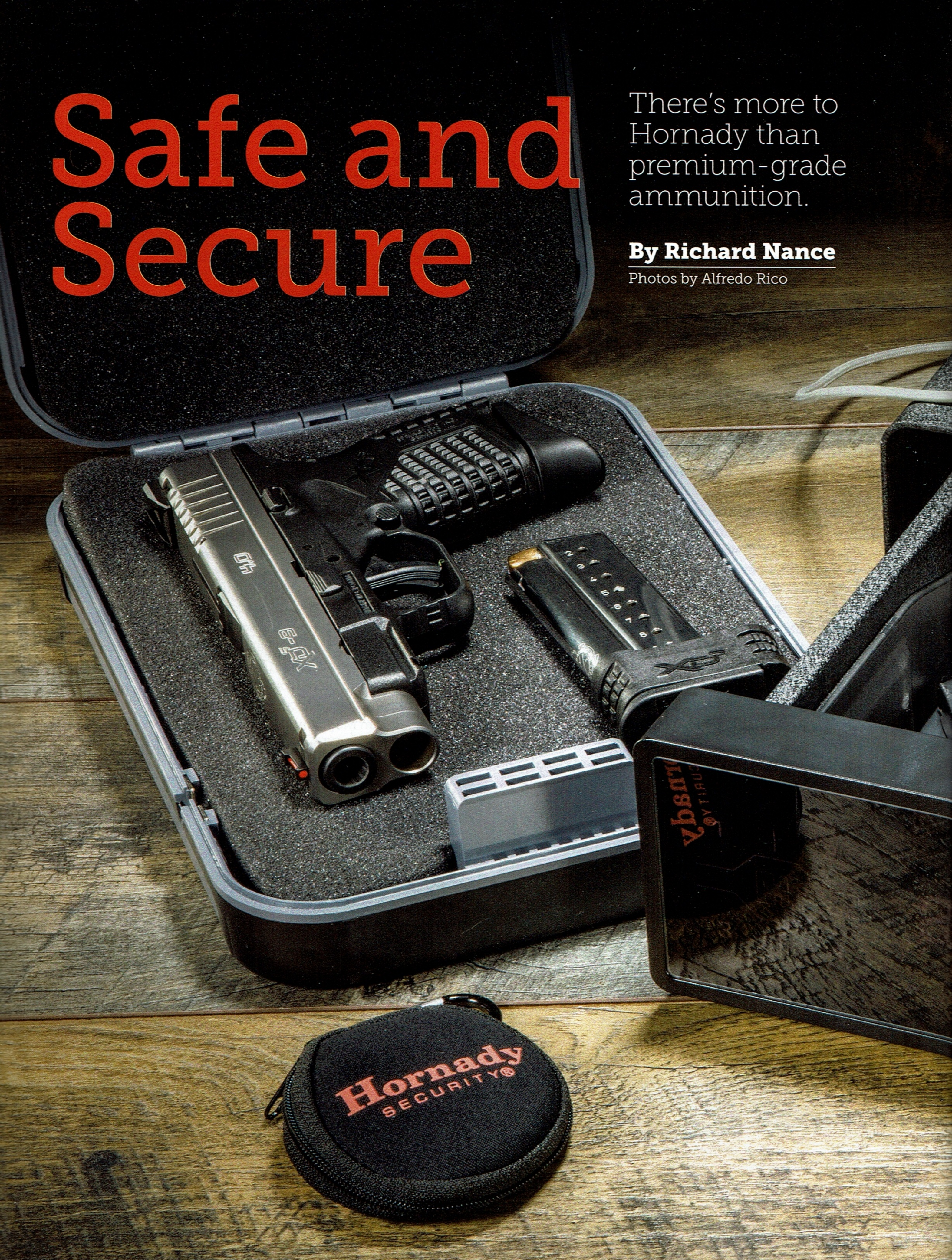
Hornady has done an excellent job of honoring the roots of the Hornady ammunition product line with the reintroduction of the Frontier brand. This new Frontier ammo carries on the brand's legacy of high-quality, trouble-free performance, and good accuracy at a very attractive price. You'll have a hard time finding a low-cost line of ammo with as many offerings and of better quality than Hornady's Frontier. H

Safe and Secure

There's more to Hornady than premium-grade ammunition.

By Richard Nance

Photos by Alfredo Rico


Hornady
SECURITY

PROGRAM
1 - Press and release red button.
2 - Hold RFID tag above button on lid or enter 4-6 digit code into keypad.
RESET
1 - Press red button for 5 seconds, release and press again to confirm.
1 2 3 4 5
SUREFIRE

When you think of Hornady, firearm storage solutions might not come to mind, but they should. In addition to providing quality ammunition that law enforcement and private citizens have come to rely on for duty, self-defense, hunting, competition, and recreational shooting, Hornady and SnapSafe provide an array of innovative products to secure your firearms and other valuables.

Hornady Security was established in 2013 after Hornady purchased a patent for RFID technology from the owners of SnapSafe. Two years later, Hornady Security acquired SnapSafe, which continues to operate as a subsidiary company.

While venturing into the realm of firearm and valuable storage may seem like a stretch for an ammunition company, Hornady felt they could provide innovative and effective storage solutions for responsible gun owners, according to Hornady Security Project Manager, Matt Mack.

I remember reviewing Hornady Security's first pistol safe while filming an episode of *Guns & Ammo* TV about a decade ago. The safe was the first to implement RFID technology. Various RFID chips could be held to a sensor to spring the lid open. The prototype was so new that there was even a piece of duct tape holding an internal component in place.

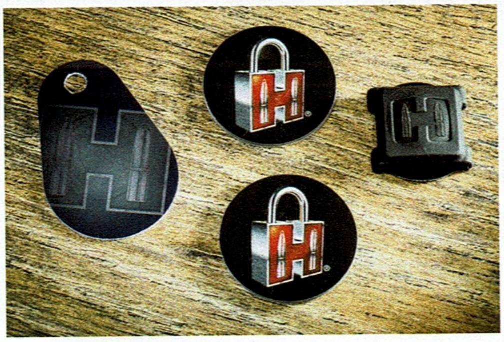
Fast forward 10 years, and Hornady Security offers dozens of products including keypad vaults, lock boxes, and RFID enabled RAPiD safes – all without the need for even a strip of duct tape. They also carry security products featuring their innovative Square-Lok system, a unique paneling that enables you to customize the arrangement of shelves within the unit.

One of Hornady Security's most popular product lines is the RAPiD Safe. These innovative safes rely not on keypads or biometrics to open but rather on RFID tags incorporated into a watchband, a key fob, or a decal, which can be affixed to your cell phone, for instance. A RAPiD Safe's lid springs open when the RFID tag is held to the safe's sensor. A four- to six-digit code or one of the supplied barrel keys can also be used to open the safe.

RAPiD Safes exceed the most stringent ASTM International safety standards. They are also listed by the California Department of Justice as an approved firearm safety device. Hornady is a supporter of Project ChildSafe, who partnered with more than 15,000 law enforcement agencies and have distributed more than 26 million firearms safety kits nationwide.

Top-quality ammunition isn't the only thing Hornady is known for. Proper firearm storage is just as important.

RFID chips come in several forms and are the key to opening safes equipped with the technology. When the chips are held close, the safe will unlock.



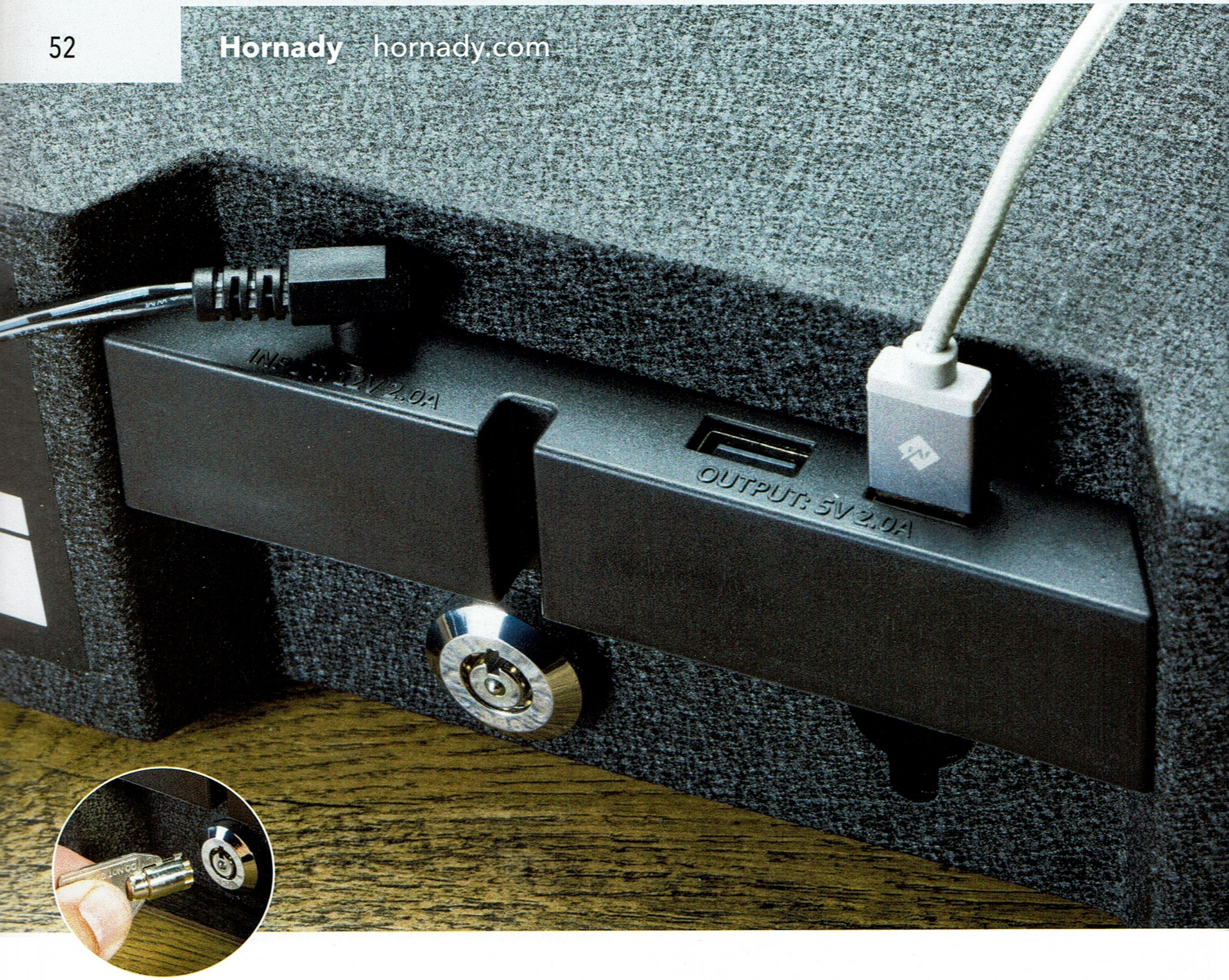
The Night Guard exemplifies the fast, reliable, touchless entry that has become a hallmark of the RAPiD Safe line. This discreet looking bedside safe grants you quick access to your handgun while safeguarding it from unauthorized users.

Constructed of heavy gauge steel, the Night Guard weighs 18 pounds and measures 12 inches long, 10.5 inches deep, and 3 inches high. Interior dimensions are 9.2 inches long, 6.9 inches deep, and 2.2 inches high. It's big enough to accommodate most full-sized handguns.

A digital clock display is protected by a tempered glass panel. The clock helps the Night Guard look right at home on the bedside table. Pre-drilled holes enable the Night Guard to be secured to a hard surface, so it can't easily be stolen. To further deter the theft of your safe, the supplied 1,500-pound rated security cable enables you to secure the Night Guard to a stationary object.

The Night Guard's access keypad can be used to open the safe if an RFID tag isn't on hand. USB charging ports enable you to charge your phone or other electronics with the Night Guard, making it as practical as it is tactical. Like the clock, the charging ports help disguise the fact that the Night Guard is first and foremost a gun safe. The RAPiD Safe Night Guard costs $334.

In addition to premium grade, technologically advanced products, Hornady Security hasn't neglected entry level users looking for a more affordable solution for firearm and valuable storage or those with a specific storage need, which is where SnapSafe



Many safes come with barrel keys as an alternative means of opening.

fits into the equation. Combining innovative design with affordability, SnapSafe's product line consists of modular safes as well as specialty safes for under the bed, in the vehicle, or even in the wall.

On one end of SnapSafe's product spectrum, there's the modular Super Titan Double Door safe with a recommended capacity of 36 or 56 long guns, depending on whether you opt for the XL or XXL model. The Super Titan's Electromagnetic Pulse (EMP) resistant lock can be opened electronically or mechanically.

Constructed of 9-gauge, two-ply exterior walls, the Super Titan's steel doors are sledgehammer and pry-bar resistant. The interior is lined as are the adjustable shelves, which include a full shelf, two half shelves, a divided shelf, and a full gun rack. The Super Titan is assembled using 14 separate 1-inch chrome steel live locking bolts, which are tightened using the supplied wrench. No other tools are required. Pre-drilled holes facilitate floor mounting for additional security.

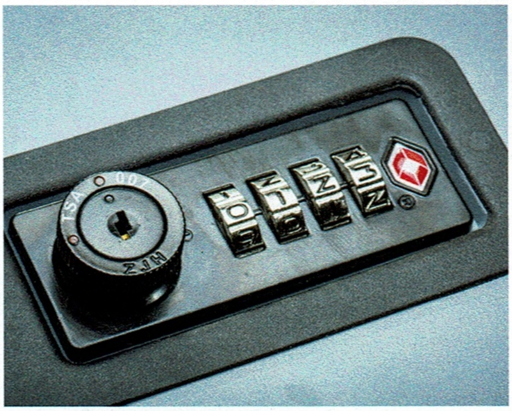
A 2,300-degree Fahrenheit, one-hour Fire Shield protection rating and heat-activated door fire seals help protect the safe's contents in case of fire. Magnesium oxide interior panels are impervious to fire, moisture, mold, and insects. The Super Titan comes with a lifetime warranty. It retails for $3,269.

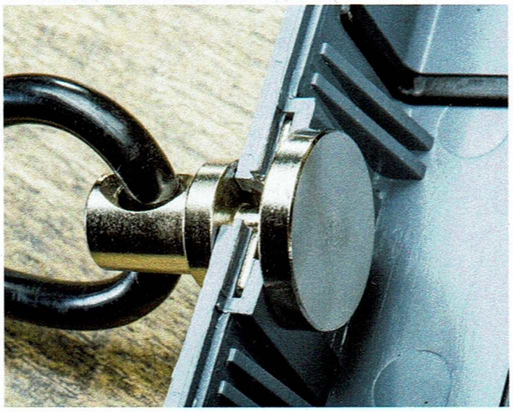
SnapSafe also offers portable storage solutions such as the TrekLite Lock Box, which is available in either a Key Lock (with two barrel keys) or a TSA Combination Lock version with over 10,000 possible codes. With external dimensions of 10 inches long, 7 inches wide, and 2 inches tall, the TrekLite is designed to ride inside a checked suitcase.

Constructed of impact resistant polycarbonate, the TrekLite weighs just 1.6 pounds. (A comparable steel lock box would weigh about three times as much). The foam interior lined TrekLite is a great way to safeguard a handgun, but it could also store medication or valuables while traveling. A patented security cable gives you the option of affixing the TrekLite to a fixed object like a seat fixture in your vehicle.

The TrekLite is available in grey or flat dark earth (FDE) with black, non-slip rubber overmold. The Key Lock version has an MSRP of $41. The TSA Combination Lock model is $9 more. Either way, the TrekLite offers the traveler affordable peace of mind.

No matter what your storage needs, Hornady Security and SnapSafe have a solution. Whether it's a dedicated, modular safe to protect your collection of long guns, an RFID enabled bedside safe to keep your handgun accessible, display the time, and charge your phone, or a lock box for when you're on the go, you're sure to find the storage solution and accessories you're looking for.

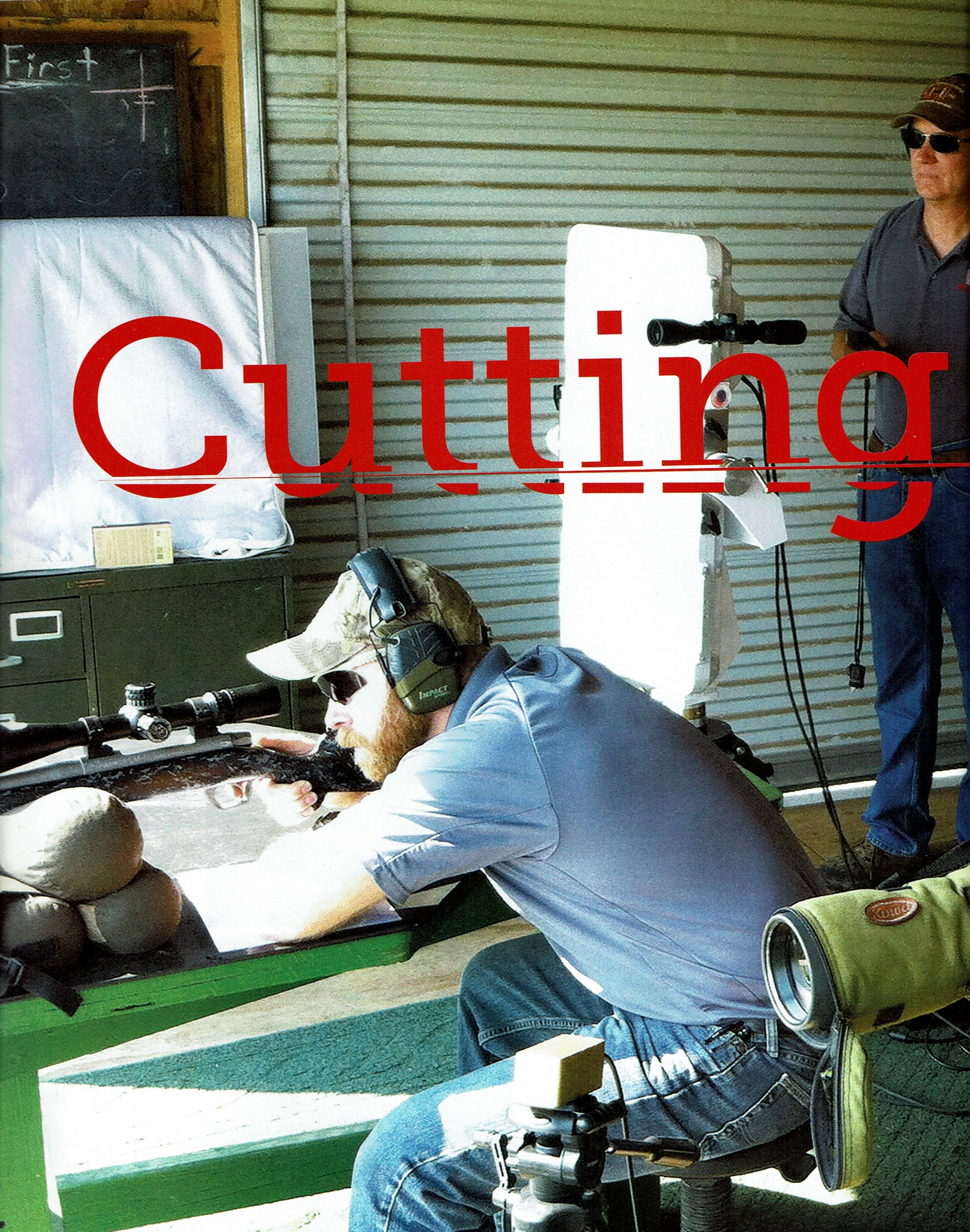




Four AAA batteries power the Night Guard's clock function, which helps it blend into the bedroom.

The TrekLite Lock Box is available in a Key Lock or TSA Combination Lock version.

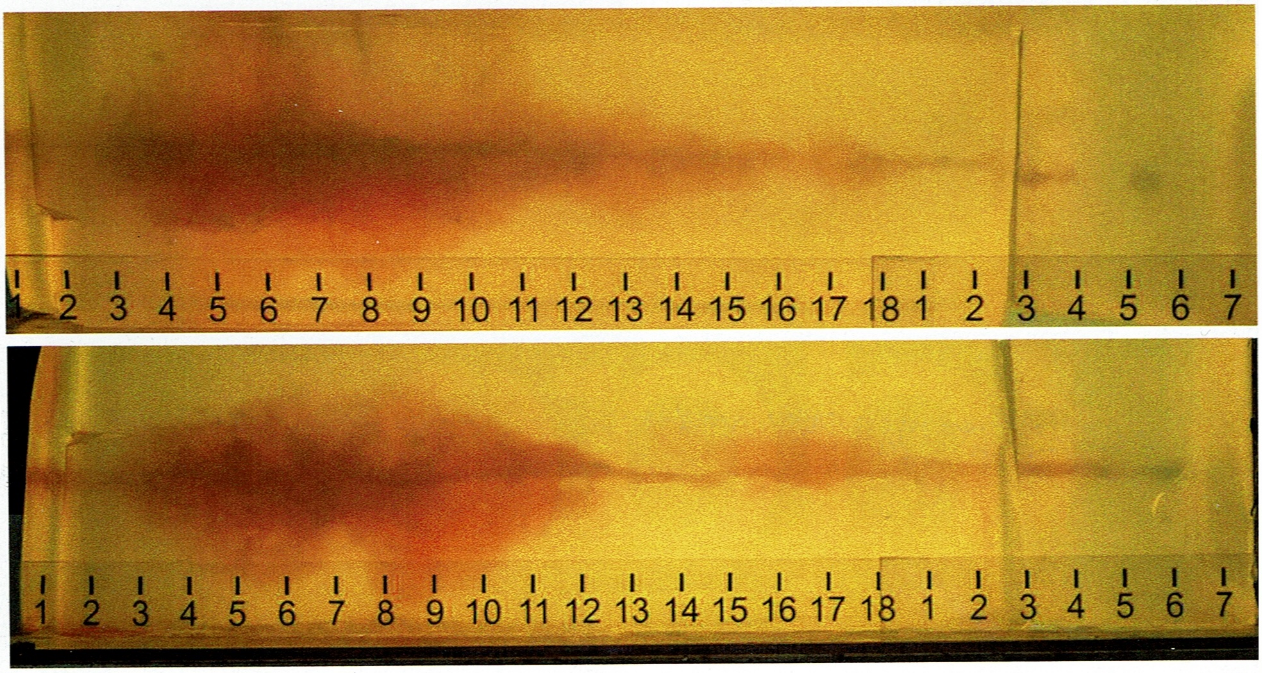
Cutting


First
IMPACT

By Dave Emary

Doppler radar and the science and development behind the ELD-X and ELD Match bullets.

Edge



ELD-X bullets were fired at 800 yards into ballistic gelatin to verify tests run in the lab. The results were identical, proving their effectiveness.

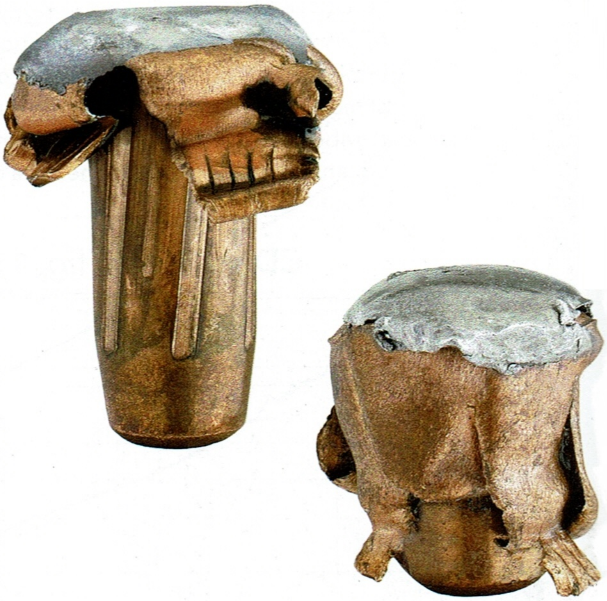
For a long time, a 400-yard hunting shot was considered long. A shot at or beyond 1,000 yards was considered very long for competition or sniping. This all began to change in the 2005 to 2010 timeframe when the hunting world began experimenting with match bullets for long-range hunting at 800 to 1,000 yards. At the same time, the military began talking to the bullet and ammunition companies about the feasibility and reality of sniping to ranges of a mile with high hit probability.

Hornady
Accurate. Deadly. Dependable.
BULLETS
ELD-X
Extremely Low Drag-eXpanding
ELD-X
7mm
162 gr
ELD-X®
Qty: 100
#2840
.284"
Hornady

With the design philosophy of the ELD-X bullets set, the line was expanded as quickly as possible.

Competitions began springing up for match shooting with ranges way beyond 1,000 yards. Up to this point, there wasn't a lot of attention paid to the aerodynamic performance of bullets and the design optimization for extreme long-range shooting. The majority of match bullet designs were rather conservative from an aerodynamic design standpoint. They were plenty accurate but, in general, were not designed to get the most from the bullet at long ranges. Little attention was paid to the aerodynamic design of hunting bullets because enough velocity and energy was retained by most any of them that they would get the job done at 400 yards. Some of the sleeker, BTHP match bullet designs began being promoted as acceptable for long-range shooting. This may have been true for the aerodynamic and accuracy performance, but the small meplat (or tip of the nose of these bullets) resulted in unpredictable and inconsistent terminal performance. A little later, tipped, long-range hunting bullets were offered that had inflated ballistic coefficient numbers and did not achieve the accuracy or terminal performance consistency required for long-range hunting.

With the advent of the PC computer in the early 1980s, commercial Doppler radars became available. They were pricey, but the amount of information on bullet flight performance that could be gleaned was tremendous. I began using Doppler radars in the mid 1980s while doing ballistic research for the military. With the advent of solid-state radar systems, the



Above, you can see the mushrooming effect of ELD-X bullets impacting at different velocities, (left) at 1,800 fps and (right) at 2,660 fps.

cost of radars came down significantly, and by the 2000s, they were much more affordable. Doppler radars began being used by the commercial shooting manufacturers around 2010. Hornady first did work with Doppler radar in New Mexico in 2011, looking at BTHP bullet designs for long-range sniping for the Army. Initially, Doppler radars were essentially used as expensive, glorified chronographs. This all began to change in 2014.

The ELD-X and ELD-M Story

By 2014, it was obvious that long-range hunting was here to stay and that hunters were going to do it whether they had reliable bullets or not. It was also obvious the military wanted a sniping capability that was far beyond what was currently state of the art. Hornady made the decision to make a high-performance hunting bullet line that gave reliable expansion to the longest possible ranges. The bullet had to be match accurate to achieve this. The terminal performance criteria called for a bullet design with a blend of high weight for the caliber, maximum retained velocity, acceptable retained weight at short ranges, and optimized aerodynamic performance for the highest possible retained velocity and expansion at long ranges.

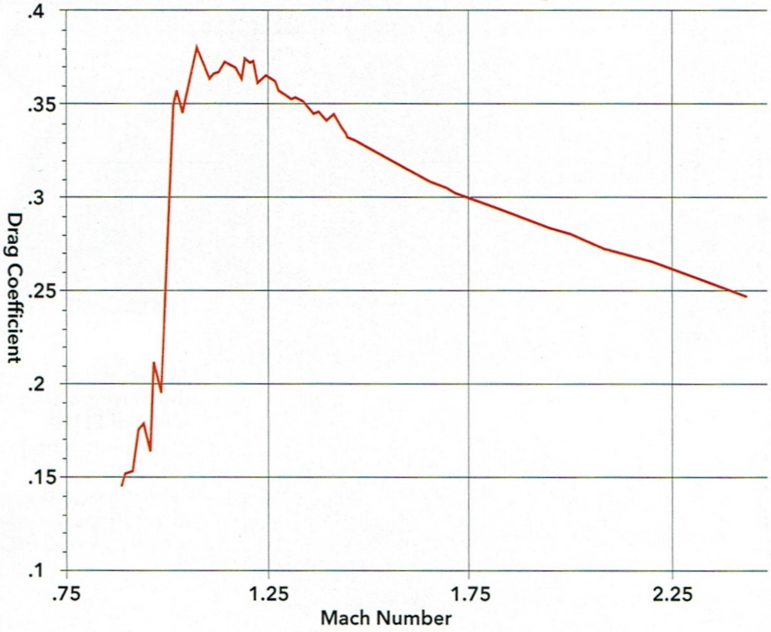
Previous bullet design and testing work had shown a practical lower limit velocity of 1,600 to 1,700 fps for effective expansion. This drove what was possible. Hornady also decided that a drawn cup and swaged lead core design would achieve higher levels of accuracy based on their own bonded bullets and from testing those from other manufacturers.

The decision was made early on to purchase a Doppler radar to quantify the aerodynamic design and features necessary for optimum long-range performance. Hornady was not using the radar as a long-range chronograph. They wanted to see how the projectile was flying and what effects on downrange performance different parameters had. In short, Hornady was after what the aerodynamic drag was on the projectile and how to minimize it.

Basic projectile design features and their effects on the projectile were well known and documented. It remained to be seen how all these parameters could be optimized within a working hunting bullet. The radar essentially provides a high-speed video of the entire flight drag performance of the bullet. You could see the effects on drag of subtle changes in the bullet. This isn't possible with a chronograph. A chronograph provides a snapshot in time, and you have no idea what happened in between the chronographs.

Going into this, the goal was to design a tipped bullet. The tip helped initiate expansion at lower velocities and provided slightly lower and more uniform drag performance because of the consistent meplat shape. The Doppler radar almost immediately became instrumental in affecting the design of the bullets. The first bullets had old-school Delrin polymer tips. Initial testing involved the prototype ELD-X bullets and BTHP bullets of similar weight and shape for comparison. It was quickly noticed that the Delrin tipped ELD-X bullets had peculiar drag performance at high Mach numbers. The drag curves at high Mach numbers should be relatively flat or gradually increasing and concave shaped. The data did not show this.

CD vs. Mach (fig. 1)



CD vs. Mach (fig. 2)

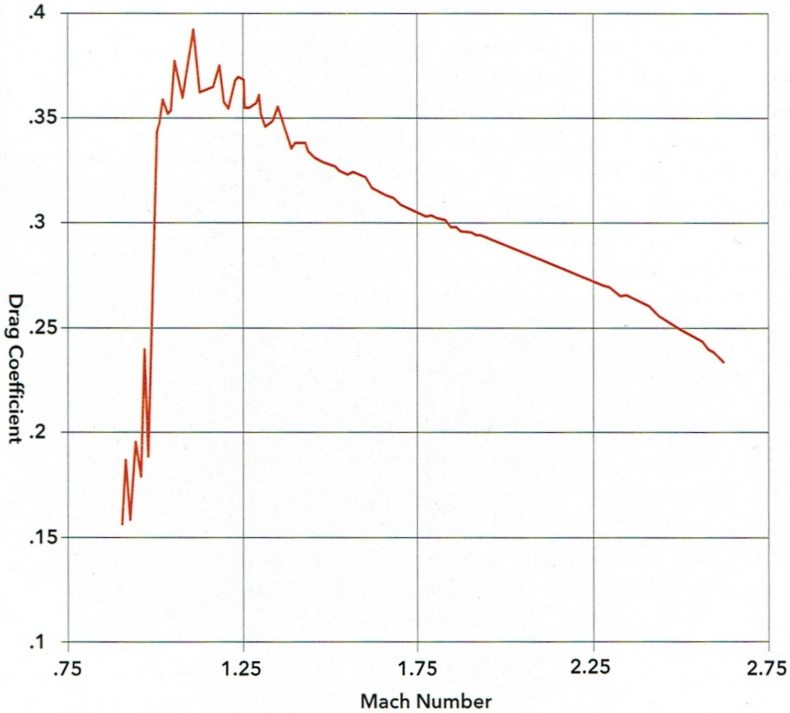
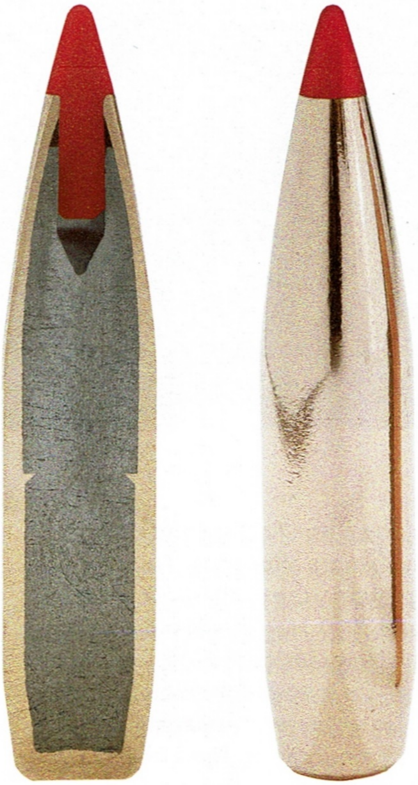


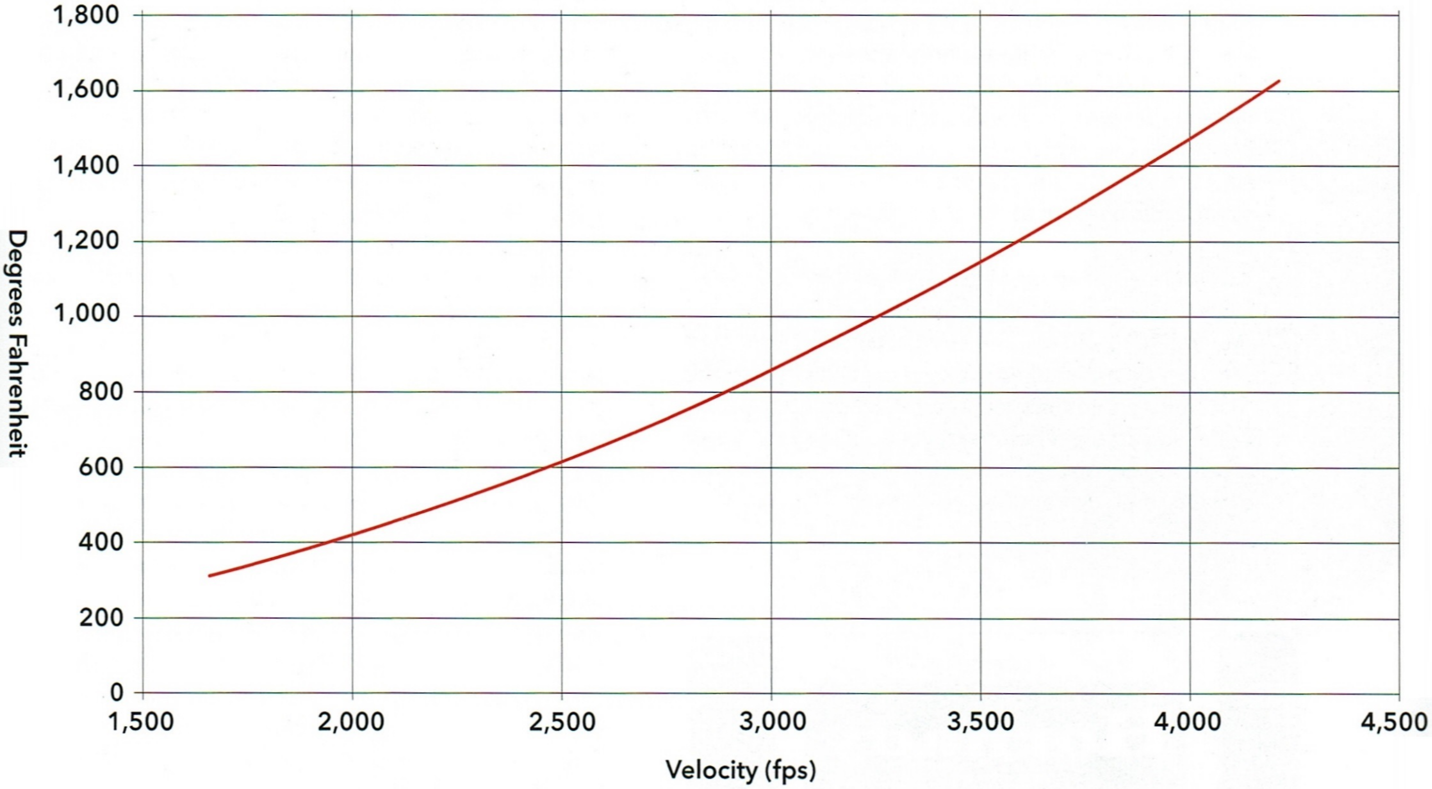
Figure 1 shows the drag curve for the metal tipped BTHP bullet. Figure 2 shows the drag curve for the Delrin-tipped prototype bullet. You can clearly see the difference in the high Mach number drag behavior of the two bullets.



A heavy and high InterLock ring keeps the shank of the ELD-X jacket and core together.

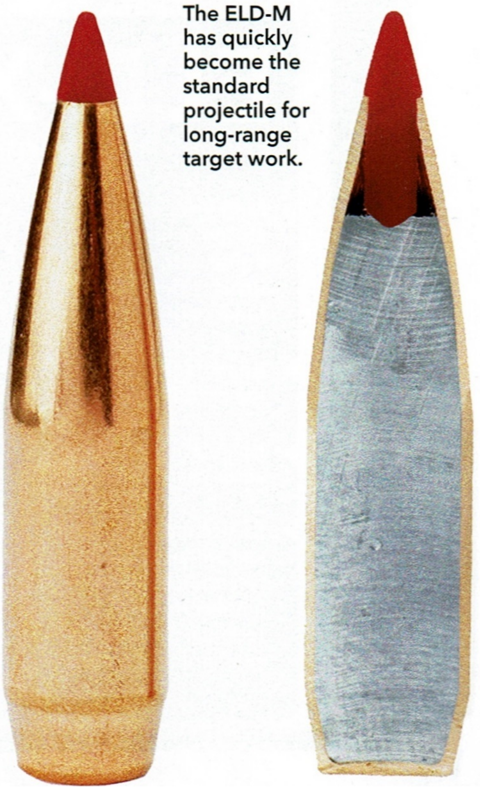
The stagnation temperatures (the temp resulting from stopping the high-speed airflow at the point of the nose of the bullet) are easy to calculate and are a function of the velocity of the bullet. The stagnation temperatures are way above the melting point of the Delrin (340 degrees Fahrenheit) at the speeds these bullets were being fired at (2,800 fps). Figure 3 shows stagnation temperature versus velocity. It seemed logical that, even with relatively short flight times of 1 to 1.5 seconds, the tip melting and deformation was a distinct possibility. Aluminum tips were made that duplicated the Delrin tips, and the test was reshot. The drag coefficient curve now looked normal and showed lower drag. The low temperature Delrin tips were melting and becoming larger early in flight. Now the hunt was on to see if a polymer could be found that would withstand these kinds of temperatures for a short period of time.

Stagnation Temp vs. Velocity (fig. 3)



After much consultation with polymer suppliers, a plastic was found that had over twice the melting point temperature of Delrin and was still cost effective and injection moldable. The trade name of Heat Shield was used for tips made of this material. The high temperature and long dwell times experienced by heavy, low drag bullets could potentially cause tip melting even with the best plastics if velocities were pushed to extreme levels. Extensive testing showed this did not happen with the Heat Shield tips within the velocity levels produced by virtually any commercial cartridge. This phenomenon is what ultimately resulted in using aluminum tips in the A-TIP bullets. The aluminum eliminates any possibility of tip melting even on heavy, low-drag projectiles that are driven to high velocities for extreme long-range shooting.

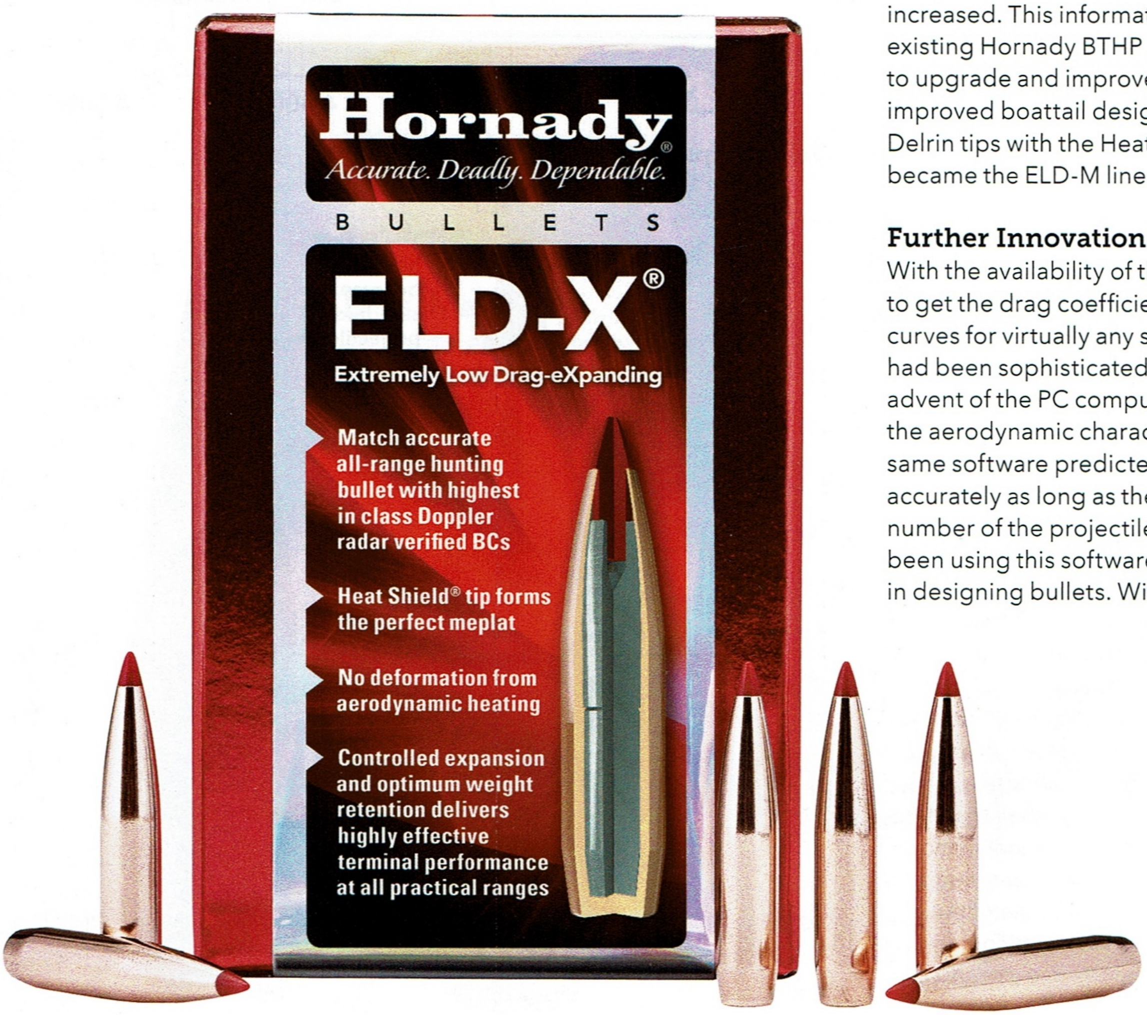
The aerodynamic design was done, and all that remained was refining the design for terminal performance. As discussed above, the decision was made early to not pursue a bonded bullet because of the high levels of accuracy required. The bullet couldn't blow up at short ranges yet still needed to expand at low retained velocities.



The ELD-M has quickly become the standard projectile for long-range target work.

The nose was designed for low-speed expansion, down to 1,600 to 1,700 fps. This gave expansion to long ranges. For shorter-range terminal performance, the entire shank of these long bullets was drawn to be quite thick, not just the back end of the bullet. The jacket taper was confined to the nose, not the shank. It was also found that a heavy and high interlock ring kept the shank of the jacket and core together and stopped expansion at the interlock in high-speed impacts.

With careful tuning of the taper of the nose of the jacket, it was found that, at high impact velocities, the bullets would expand to a certain diameter and shed a little material then begin expanding again to that same approximate diameter. By doing this, the bullet stayed together at high impact velocities and produced consistent expansion diameters and still expanded at low retained velocities.


Hornady®
Accurate. Deadly. Dependable.
BULLETS
ELD-X®
Extremely Low Drag-eXpanding
Match accurate all-range hunting bullet with highest in class Doppler radar verified BCs
Heat Shield® tip forms the perfect meplat
No deformation from aerodynamic heating
Controlled expansion and optimum weight retention delivers highly effective terminal performance at all practical ranges

Extensive testing was done in a lab environment, replicating long-range ballistics by using short, fast twist barrels with a small capacity case. This was done to reproduce long-range retained velocity and bullet spin rates. Actual field testing was done at 800 yards with fairly large stacks of gelatin to verify. The results were virtually identical whether done in the lab or at distance. The design of the bullets was completed in 2015, and the line was introduced in 2016.

The design philosophy was set, and the ELD-X line was expanded as rapidly as possible. The lessons learned on tip materials and aerodynamic design of the bullets was applied to match bullets, which resulted in the ELD-M line. The aerodynamic testing done during the ELD-X work verified published Army data for projectile shape and drag characteristics, albeit based on large-caliber artillery projectiles. This testing also showed that the shape and length of the boattail was critical for lowest drag. There is a relatively small window for length and angle. If it got outside this, either stability began to suffer or drag increased. This information was introduced into the existing Hornady BTHP and A-MAX lines of bullets to upgrade and improve their performance. The improved boattail designs along with replacing the Delrin tips with the Heat Shield tips in the A-MAX line became the ELD-M line.

Further Innovation from Radar

With the availability of the Doppler radar, it was easy to get the drag coefficient versus Mach number curves for virtually any small arms projectile. There had been sophisticated software available since the advent of the PC computer to model and predict the aerodynamic characteristics of a projectile. This same software predicted the trajectory extremely accurately as long as the drag coefficient versus Mach number of the projectile was known. Hornady had been using this software since the early 1990s to aid in designing bullets. With the advent of affordable

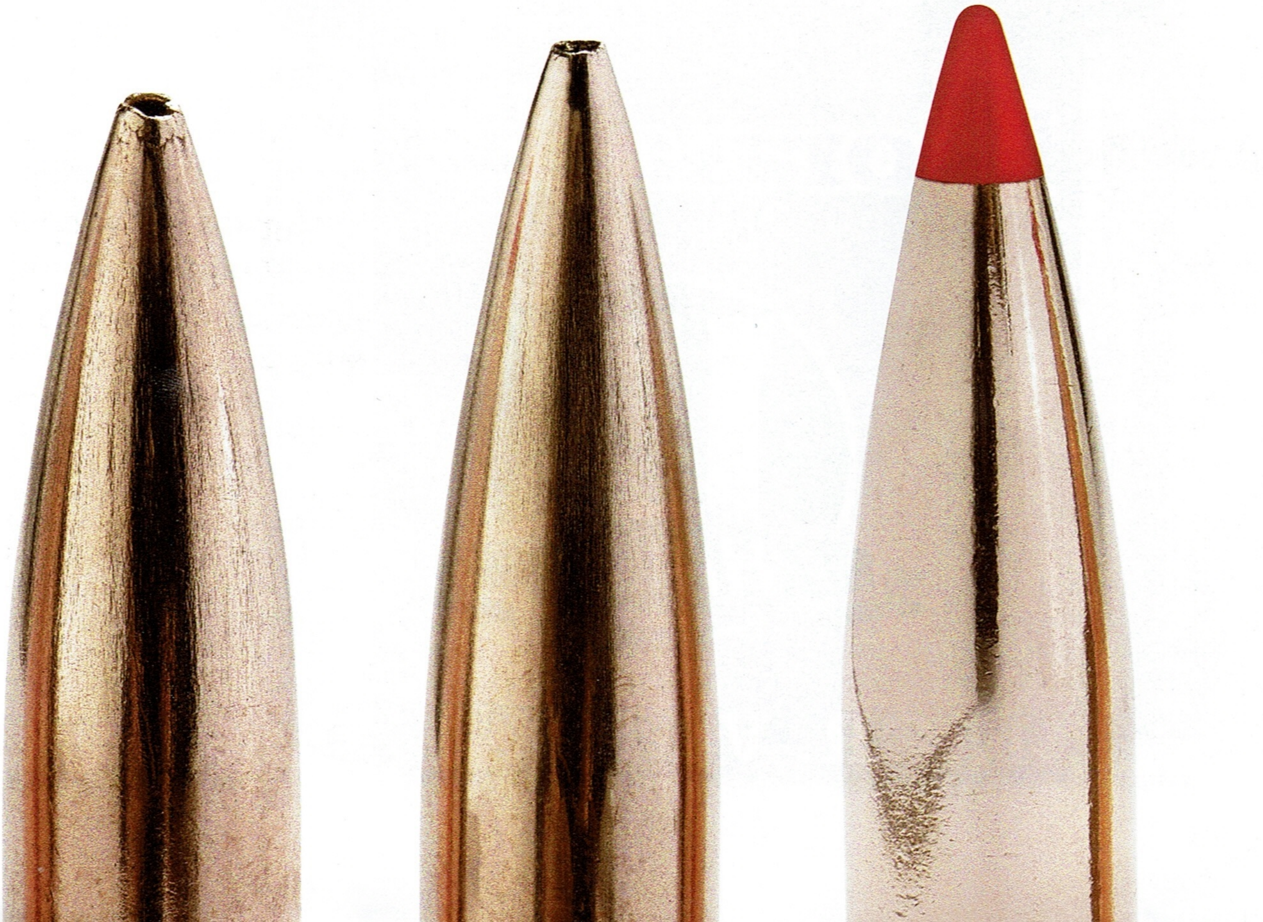
Doppler radar, it was now possible to generate the actual drag performance of virtually any small arms projectile. Hornady began experimenting with using the Doppler radar drag data with the PC software package and found that the accuracy of long-range ballistics predictions virtually overlaid the actual radar data. It also resulted in incredibly accurate trajectory and come-up predictions for scope settings to extremely long ranges. This was not possible with any other ballistics prediction software that existed at the time. This work led to the development of the 4DOF Ballistic Calculator software and phone app.

Summary

In the last 10 years, the availability of high-performance, affordable Doppler radar systems has resulted in huge leaps forward in the shooting sports and military sniping. The information available from radar has resulted in the highest performance projectiles that have ever been produced. It has also led to huge advancements in trajectory and ballistics prediction capabilities that had only been available to the military for primarily artillery applications. With the availability of essentially handheld computers, our cellphones, this could truly be a golden age of shooting.

Using what they'd learned about tip materials and aerodynamics while developing ELD-X bullets, Hornady applied the same design to their match bullets, and ELD-M was born.

Hornady
BULLETS
ELD® MATCH
Extremely Low Drag
ELD® MATCH
6.5mm
100 gr
ELD® MATCH
Qty: 100
#26100 .264"
MADE IN THE USA



Heat Shield tips create the perfect meplat and outperform BTHP bullets.

17 GR.
V-MAX™
Hornady
17
HMR
50 rounds
Read all warnings before use.
Hornady
17
HMR®
17 GR. V-MAX™

Hornady's Magnum Rimfire

Reflecting on 20 years and one billion rounds of .17 HMR.

Yes, that's billion with a "b." Hornady has given shooters a lot to be thankful for in the last 20 years: LEVERevolution, Creedmoor and PRC cartridges, Critical Defense, Critical Duty, ELD Match and ELD-X bullets, and much more. One of Hornady's grand-slams was the .17 Hornady Magnum Rimfire (HMR), which was introduced in 2002.

By Craig Boddington

Photos by Michael Anschuetz

At the start of the new millennium, then-ballistics engineer Dave Emary was working on a Christmas present for his father. His dad had a rifle in .22-250 that Emary had given him for Christmas in '75. Fast-forward a quarter century, and his dad was getting older and no longer comfortable shooting the old .22-250. So, the project started out as a hand-built .22 Magnum. His dad loved his birds, so the rifle was to be used for sniping woodchucks and squirrels that kept getting into the bird feeders.

"I was a little bored," Emary recalled, "and I'd always been disappointed in the accuracy of most any rimfire I ever fired. While working on the .22 Magnum, I got to thinking, 'What if I necked the case down to .17, designed my own chamber, and used high-quality bullets?'"

There's more to the story, but that was the start. His dad loved the one-of-a-kind "17/22 Magnum" and raved about its accuracy.

WHAT'S IT FOR?

I have a bad habit of asking that question when a new cartridge comes along. If I don't immediately see purpose and need, I figure it doesn't have a chance. (The .17 HMR isn't the only cartridge I've been wrong about!) Emary and his dad "got" the .17; they'd seen the accuracy and deadly efficiency, but I didn't get it. As legend has it, neither did Steve Hornady. Emary

knew he had something special, but the boss was unconvinced and rejected the concept over and over.

Hornady told this one himself around a campfire: "I was sick of hearing about it, so I finally gave in, and I told Dave he was betting his job!"

Hornady made the bullets, but from the beginning, Hornady .17 HMR ammo has been loaded by CCI.

Emary again: "Hornady asked me how many rounds I thought we should order from CCI for the first year's production. I told him, '50 million.' I've known Steve Hornady a long time, and I could see him choking. 'No way!' he said, 'I'm going to order four million.' The actual volume in the first year was nearly 100 million rounds."

FUN — AND DEADLY

Here's what I didn't get about the .17 HMR: It was fun! Shooting is always fun, but it's more fun if you hit what you're shooting at without getting kicked around. The .22 WMR is an extremely capable little cartridge, but accuracy is usually pedestrian. Right out of the starting gate, the .17 HMR became known for tack-driving accuracy. With a 17-grain Hornady V-MAX bullet traveling at 2,650 feet per second (fps) and a 20-grain V-MAX at 2,350 fps, it's a hot little number. Hornady added a 15.5-grain NTX bullet at 2,525 fps, an essential load for areas where non-lead projectiles are required. On small varmints like prairie dogs, the HMR is good for a couple hundred yards, and it's powerful enough for fox and coyote. There's no recoil, fairly mild report, and it's relatively inexpensive. What's not to like?

I have a plain Marlin XT-17 bolt-action with heavy barrel that's ridiculously accurate. It lives on my Kansas farm, where our number one pest is armadillos that invade from Oklahoma. Oh, boy, the little .17 HMR is impressive. Although it's an uncommon cartridge over there, one year, I used it in Namibia. It was great for Cape fox and the small antelopes.

The HMR is a bit too destructive for edible small game such as rabbits and squirrels, unless you restrict yourself to head shots. (You can because the cartridge is plenty accurate.) However, for me, one of the HMR's greatest roles is rodent reduction. The last few years, I've been doing an annual prairie dog shoot near Cheyenne, Wyoming, with industry friends. We alternate from rimfire to centerfire and back again, but Missourian Bill Green is the .17 HMR king! The last two shoots, his centerfires never made it out of the gun case. Green uses a semiautomatic Savage A17, and he makes it talk. I've seen him hit prairie dogs beyond 300 yards with his HMR. (No, you're not going to hit them all at that distance, and the wind call may be several feet.) When he connects on a long one, a big grin is automatic. I'm continually amazed at what that tiny little cartridge will do.

The .17 HMR is based on a simple necking down of the .22 WMR case. According to the HMR's designer, retired Hornady Engineer Dave Emary, accuracy comes primarily from a very precise chamber and good bullets.

THE ACCURACY SECRET

The first .17 HMR rifle was a Marlin Emary had from his grandfather, using a shot-out, cut-off, and rechambered .17 Remington barrel. From the beginning, Emary was after accuracy, and he credits the consistent accuracy of the .17 HMR to two primary factors: The chamber and good bullets. Hornady partnered with Marlin and Ruger to manufacture the first .17 HMR production rifles. The body of Emary's chamber has clearances similar to the .22 WMR chamber, but the throat has a minimum .0005-inch clearance and maximum .001-inch. That's five 10-thousandths to one-thousandth! Emary said, "I remember telling the guys at Marlin and Ruger that they needed to keep bore and groove and the throat dimensions tight, or the cartridge would lose its appeal. The late Harold Waterman at Marlin understood this, and they were very careful."

Obviously, Hornady knows how to make bullets. The difference with the .17 HMR, however, is that the .17 HMR bullets are not "rimfire" bullets; they're premium rifle bullets made to Hornady's conventional production standards. Massive numbers brought ammo costs down, but .17 HMR ammo is still costlier than much rimfire ammo due to the cost of the bullet.

Marlin and Ruger were first, but it didn't take long for most rifle manufacturers to jump on the .17 HMR bandwagon. You can do the math; it takes a lot of rifles to burn through a billion rounds. The majority of manually operated .22 WMR rifles could simply be rebarreled to .17 HMR with few mechanical changes.

There were, however, challenges (and some notable failures) in developing reliable .17 HMR semiautomatics. Although said for years, it is not true that "the .17 HMR is not suitable for semiautos." Savage broke the code with its A17, introduced in 2015, using a delayed-blowback action. The Savage isn't alone. Alexander Arms has been making .17 HMR AR uppers for 10 years. However, the Savage was the first economical semiauto designed from the ground up around the .17 HMR cartridge.

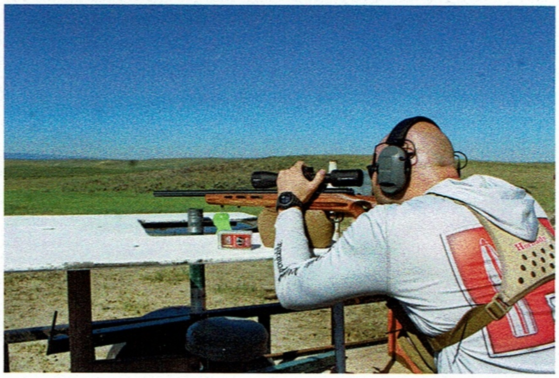
As rifles proliferated, so did ammo. CCI loads .17 HMR for Federal, Remington, and Winchester. PMC and Sellier & Bellot also catalog .17 HMR offerings.

THE DOG TOWN

In early July 2021, I joined Hornady's Seth Swerczek, outdoor writer John Haviland, and *American Hunter's* Editor Scott Olmsted for a prairie dog shoot out of Casper, Wyoming – specifically to celebrate the .17

Ranchers detest prairie dogs because they eat grass and ruin pasture. Periodic shooting is a sound alternative to poisoning them.

WINCHESTER
SUPER X
17 HMR
2375 FPS 20 GR. GAMEPOINT®
WARNING: Keep out of reach of children. Read all warnings on package.
50 CARTRIDGES/CARTOUCHES
CCI
TNT®
17 HMR
17 HMR JACKETED HOLLOW POINT
2550 FPS
17 GRAIN
VARMINT
17 GR. V-MAX™
Hornady
17 HMR®
50 rounds
VARMINT TIP
2650 FPS • 17 GRAIN
100 FPS FASTER THAN OTHER 17 HMR LOADS!
A17
Savage Arms
Optimized for the Savage Arms™ A17 rifle
200 ROUNDS



Swerczek recently separated from the U.S. Marines, which showed in his ability to assume the various field positions.

HMR's 20th birthday. I'm probably not as avid a prairie dog shooter as I once was – some restraint comes with age – but I turn down few chances and for good reason. First, ranchers hate the little rascals because they eat grass and even more because their burrows and mounds destroy pasture. I doubt it's possible to eradicate them by shooting, and that isn't the goal. Rather, periodic shooting thins them a bit, and the only other alternative is poisoning.

Second, the prairie dog is an awesome shooting instructor. They are small targets, and there is rarely a still day on the high plains. There's nothing better for learning to how to call wind. If you are able to hit prairie dogs consistently at a couple hundred yards, then no big game at twice the distance should be daunting. Also, it's fun! There's plenty of shooting, socializing, spotting, and coaching.

I always enjoy a prairie dog shoot, but this time I was especially eager. I've seen what my buddy Green can do with his .17 HMR rifle. I've had my Marlin since the cartridge was fairly new (and I figured out what it

With outfitter Kody Glause spotting, Boddington used a Ruger 77/17 off a tall bipod. Even from field positions, the .17 HMR was effective to beyond 200 yards.

Natural rests are not common in prairie dog towns, but when you find them, they can be as steady as a bench. Just check them for rattlesnakes before flopping down!

In the few states that allow rifles for turkey, the .17 HMR is a great option. Boddington and Joey Meiberger took these gobblers on a fall hunt in Oklahoma using a Ruger 77/17 in .17 HMR.

The .17 HMR is ideal for foxes, and it has enough power for coyotes at close range. This Cape fox was taken in Namibia with a bolt-action Marlin XT in .17 HMR.

Although rarely seen in Africa, the .17 HMR is extremely useful for the smaller antelopes. Donna Boddington took this excellent steenbok with a Marlin XT.

was for), but I've done relatively little prairie-dogging with the .17 HMR. We were shooting with Kelly Glause of Cole Creek Outfitters and his son Kody who has his own business, Heart Spear Outfitters (heartspear.com) – great guys and old friends. Swerczek was a new friend, but Haviland, Olmsted, and I go back a long way.

A fine summer morning in Wyoming, it was still slightly cool. Kody Glause stopped his truck on top of a little rise where a huge prairie dog colony sprawled in all directions. Closer dogs chirped at our intrusion. Swerczek and I unlimbered and went to work, me with a Ruger 77/17 and he with a Savage 93R17 BTV bolt-action.

The Glauses had portable benches, and we used them a bit. Mostly, we did what I call "roving" varmint shooting, i.e., we wandered from spot to shot, used sticks, field positions, and natural rests. You don't hit as many as from a solid rest with sandbags, but it's more fun and better practice. Kelly swore he had a couple of big towns that hadn't been shot. By July, that's rare, but he didn't disappoint; we had prairie dogs in sight all the time and at all ranges. If we'd been using centerfires, we'd have spent a lot of time waiting for barrels to cool.

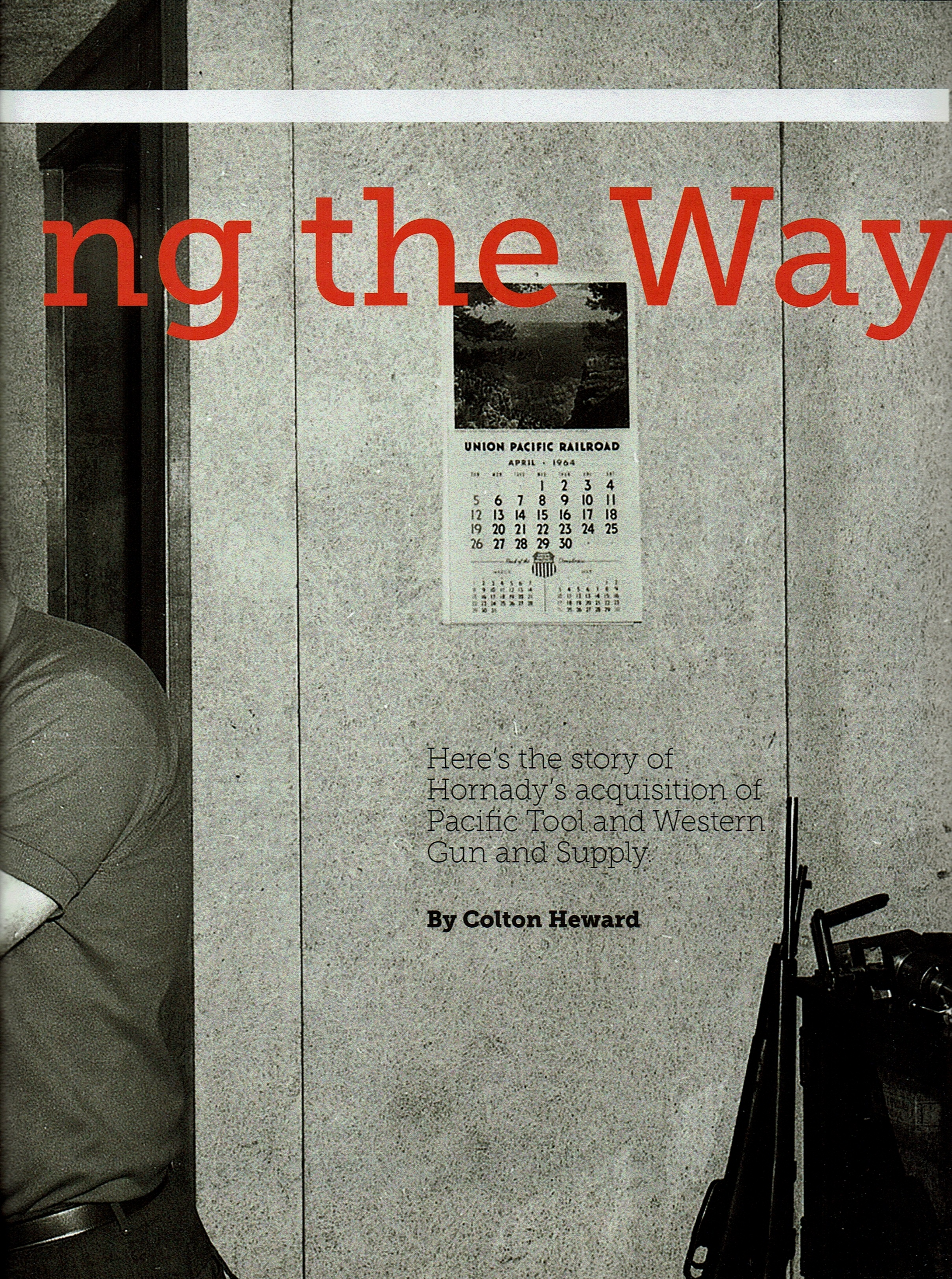
I like the .17 HMR, and I'm plenty familiar with its capabilities. Even so, I was amazed at how effective these rifles were. Out to about 160 yards, there was no excuse for misses. Past that, it got tougher. At 200 yards, we weren't going to hit with every shot; more than a puff of breeze blew the little bullets off their mark. That's part of the fun; it's a good feeling when you call the wind right.

I'll be honest: I hate to miss! I didn't attempt some of the feats that I've seen my friend Bill Green pull off. Even so, Swerczek and I both made first-round hits to 230 yards and shot a few dogs out to 250 yards. The .17 HMR shoots amazingly flat. Even beyond 200 yards, holdover isn't much, but the wind wreaks havoc.

Through the last 20 years, I doubt that I've shot my full share of those billion .17 HMR cartridges, but I did some catching up in those prairie dog towns!

Pavi

ng the Way


UNION PACIFIC RAILROAD
APRIL · 1964

Here's the story of Hornady's acquisition of Pacific Tool and Western Gun and Supply.

By Colton Heward

Since its inception in 1949, the Hornady name has been synonymous with producing premium bullets. However, producing a superior projectile that meets the rigorous demands of hunters and shooters is only half of the precision equation.

Joyce Hornady, founder of Hornady Manufacturing, sought to bridge the gap between his bullets and a finished cartridge with the acquisition of Pacific Tool. Hornady made bullets for reloaders, so why not make the equipment, too?

Pacific Tool opened their doors for business in the early 1920s in San Francisco, California. Shortly after, its invention of the "C" type reloading press in 1928 put the company on the map and kickstarted the modern era of reloading. Over the course of the next several decades, Pacific Tool experienced growing pains but remained a leader in the reloading space. By 1960, Pacific Tool had changed hands and moved shop from the West Coast to Lincoln, Nebraska. They thrived in Nebraska until some unfortunate business dealings nearly put the company under in 1969.

"A gentleman convinced my dad that he should buy Pacific Tool Company and get into reloading," said Steve Hornady, Joyce's oldest son and current president of Hornady. "He thought that since we are selling bullets, we could sell reloading tools and that it would be part of the same program."

If Joyce could have seen 50 years into the future, I doubt he would have dreamed his company would turn into the powerhouse that it is today. Pacific Tool remained stagnant until, much to his wife Marvel's dismay, Joyce Hornady purchased the company in 1971. The acquisition of Pacific Tool was a natural progression for the booming bullet manufacturer, diversifying the Hornady brand into the reloading space.

Along with the acquisition of Pacific Tool, Hornady also purchased Western Gun and Supply, which shared a building in Lincoln with Pacific Tool. It was during this time that Steve Hornady moved from the family ranch in Montana to Lincoln to attend Nebraska Wesleyan University. Steve began working for Pacific Tool and ultimately followed the company back to Grand Island when Joyce Hornady moved Pacific Tool and Western Gun and Supply operations in 1974.

Shortly after the move to Grand Island, Hornady divested their time and energy into bullets and reloading, and Western Gun and Supply was dissolved. Hornady sold off the remaining inventory from Western Gun and Supply and repurposed the building. Today, the building that was once Western Gun and Supply is now occupied by Hornady's engineering team.

"Dad never really liked that side of the business anyways," said Steve. "I still have a beautiful Browning over/under that dad snagged when we shut the doors on Western Gun and Supply."

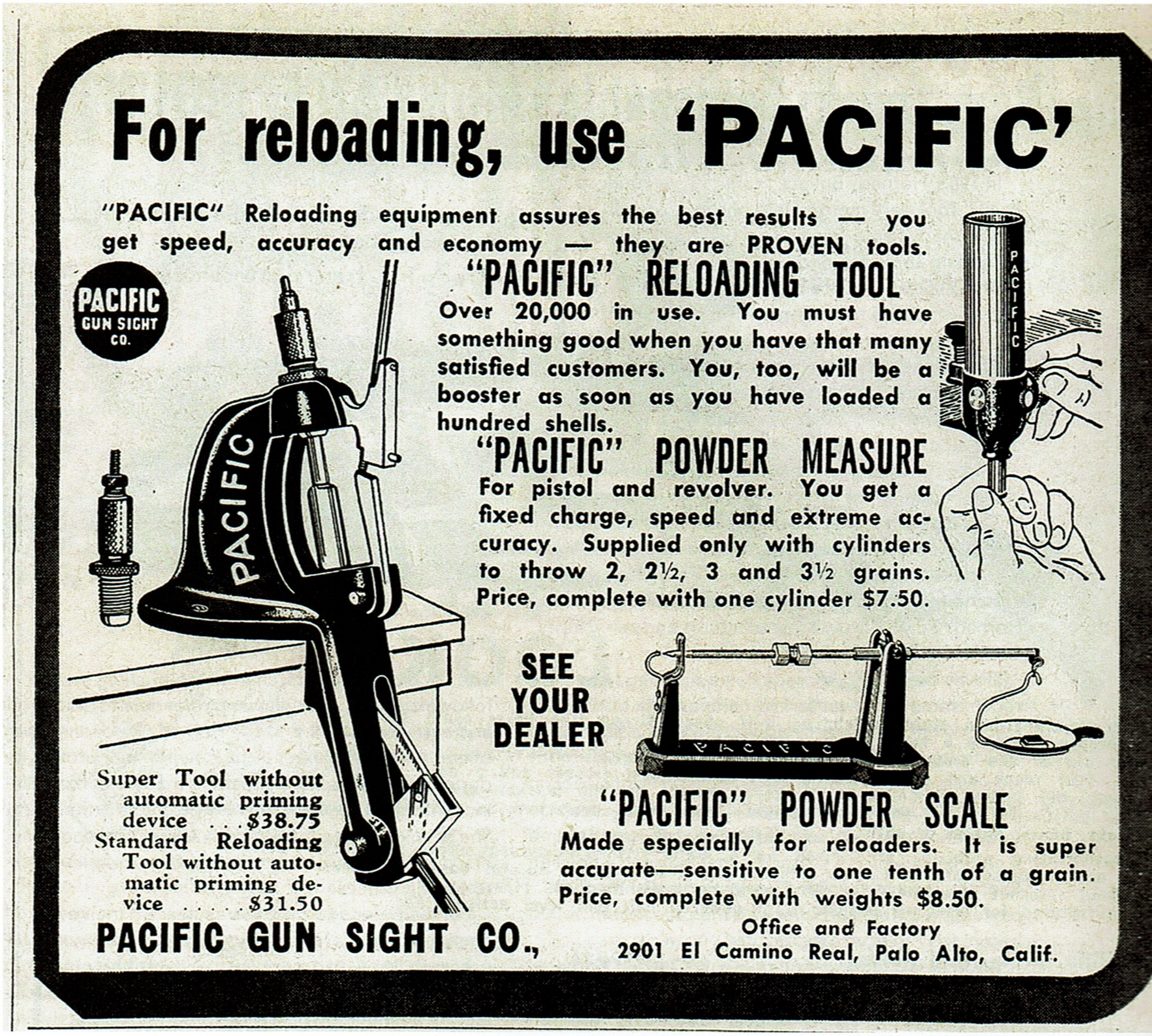
In the decade following Hornady's acquisition of Pacific Tool, gaining market share in centerfire reloading equipment was a challenge due to competition

Hornady's acquisition of Pacific Tool granted them access to an entire facility full of reloading equipment that was state of the art at the time.

from other well-known reloading brands. However, Pacific Tool had discovered a niche market in shotshell reloaders. They manufactured several models of shotshell reloaders, but the Model 105, an inexpensive and versatile reloader, fueled the company's growth.

"We put a lot more emphasis on shotshell presses early on because it was so hard to get a piece of that centerfire business back after they had lost so much of it," said Steve. The emphasis on shotshell presses also plunged Joyce and Steve headfirst into the competitive shotgunning world as they traveled around the Midwest, competing and marketing their cutting edge shotshell reloaders. Following the tragic death of Joyce Hornady in 1981, the tide began to turn for Pacific Tool.

"After dad was killed, we didn't really have anyone to carry on that mantel, and frankly, I didn't have the motivation to go to these shoots because everyone I



For reloading, use 'PACIFIC'

"PACIFIC" Reloading equipment assures the best results — you get speed, accuracy and economy — they are PROVEN tools.

PACIFIC
GUN SIGHT
CO.

"PACIFIC" RELOADING TOOL

Over 20,000 in use. You must have something good when you have that many satisfied customers. You, too, will be a booster as soon as you have loaded a hundred shells.

"PACIFIC" POWDER MEASURE

For pistol and revolver. You get a fixed charge, speed and extreme accuracy. Supplied only with cylinders to throw 2, 2½, 3 and 3½ grains. Price, complete with one cylinder $7.50.

SEE YOUR DEALER

"PACIFIC" POWDER SCALE

Made especially for reloaders. It is super accurate—sensitive to one tenth of a grain. Price, complete with weights $8.50.

Super Tool without automatic priming device . . . $38.75
Standard Reloading Tool without automatic priming device $31.50

PACIFIC GUN SIGHT CO.,
Office and Factory
2901 El Camino Real, Palo Alto, Calif.

> **"Reloading has gone back to its roots, appealing to the hobbyist, to the specialist, to the shooter that just wants to experiment to see what they can do to make it better."**

used to go with was dead," said Steve.

In 1983, Hornady Bullets, Frontier Ammunition, and Pacific Tool were merged into one corporation under the Hornady name. Pacific Tool became Hornady Reloading Tools. Hornady still produced their beloved shotshell presses, but a big emphasis was now being put on centerfire reloading equipment.

"The change really happened when we came to the recognition that consumers could buy shotshells so economically that they weren't saving that much by reloading," said Steve. "It was also apparent that excelled performance could be achieved in centerfire reloading by designing features into equipment that would appeal to the consumer."

This shift in mindset paved the way for many centerfire reloading innovations over the next several decades. It is worth noting that while the emphasis switched from shotshell to centerfire reloaders, Hornady Reloading still manufactures and services its 366 Auto shotshell reloader.

Slowly but surely, Hornady Reloading began to regain some of the centerfire market share. In 1988, Hornady completely redesigned their reloading dies from the Durachrome line that had been in service long before Hornady purchased Pacific Tool. Hornady's Custom Grade New Dimension dies featured innovative, replaceable decapping pins in the sizing die as well as a seater die that featured a new floating-alignment collar. The floating collar design perfectly aligned the bullet with the case mouth before the bullet was seated.

Another big innovation came in 1997 when Hornady released the Lock-N-Load AP press, which is still the foundation of their progressive reloading line.

UNIQUE™
CASE LUBE
Natural, non-petroleum paste lube.

The Lock-N-Load quick change die-bushing system followed shortly after, allowing reloaders to quickly and easily swap calibers. The Hornady Reloading line of equipment also extends far beyond their proven dependable lineup of presses. Hornady is continually innovating and developing new products in their long line of auxiliary equipment such as scales, dispensers, precision gauges, etc., designed to simplify the reloading process.

For many decades, shooters reloaded their own ammunition out of necessity to achieve maximum precision. However, modern manufacturing processes now allow ammunition companies to produce factory ammunition on a widespread scale that deliver

Hornady
HANDBOOK OF CARTRIDGE RELOADING
HORNADY HANDBOOK OF CARTRIDGE RELOADING
TENTH EDITION
MANUFACTURED BY
Hornady
RELOADERS
Grand Island, Nebraska

superior precision and performance. These advancements may have changed the face of modern reloading, but the therapeutic satisfaction of reloading your own ammunition will never fade.

According to Steve, reloading today is not about performance increase as much as it's an enjoyable pastime and a way to save money.

"Reloading has gone back to its roots, appealing to the hobbyist, to the specialist, to the shooter that just wants to experiment to see what they can do to make it better," said Steve. "But with some of these, the reloader is going to have a hard time making it better than we do."

Hornady is a generational, legacy brand in this industry that will continue to carry on and support the shooting sports that we love and cherish for generations to come. Whether you are a reloading aficionado or just beginning to dabble, Hornady produces a dependable, turn-key solution for all your reloading needs.

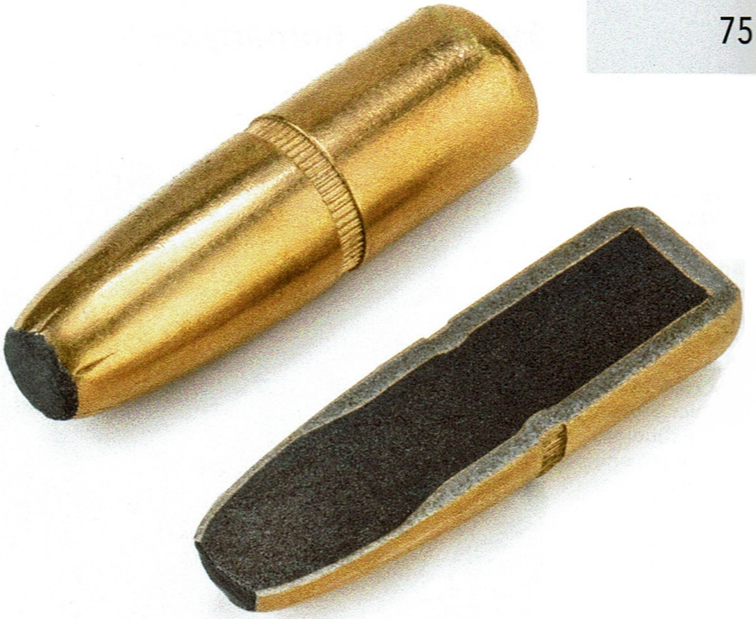
"Reloading tools are essential for what we do as a bullet manufacturer," said Jason Hornady.

You can't go wrong with modern factory ammunition, but there is an undeniable, self-fulfilling satisfaction that comes from obtaining success in the field with ammunition you loaded yourself.

20 CARTRIDGES
Accurate. Deadly. Dependable.™
Hornady
DANGEROUS GAME SERIES
DANGEROUS GAME SERIES
Dangerous Game™ Series
Hornady
416 REM
400 gr DGX®
#82673

By Eric R. Poole

Photos by Mark Fingar



Hornady DGX Bonded

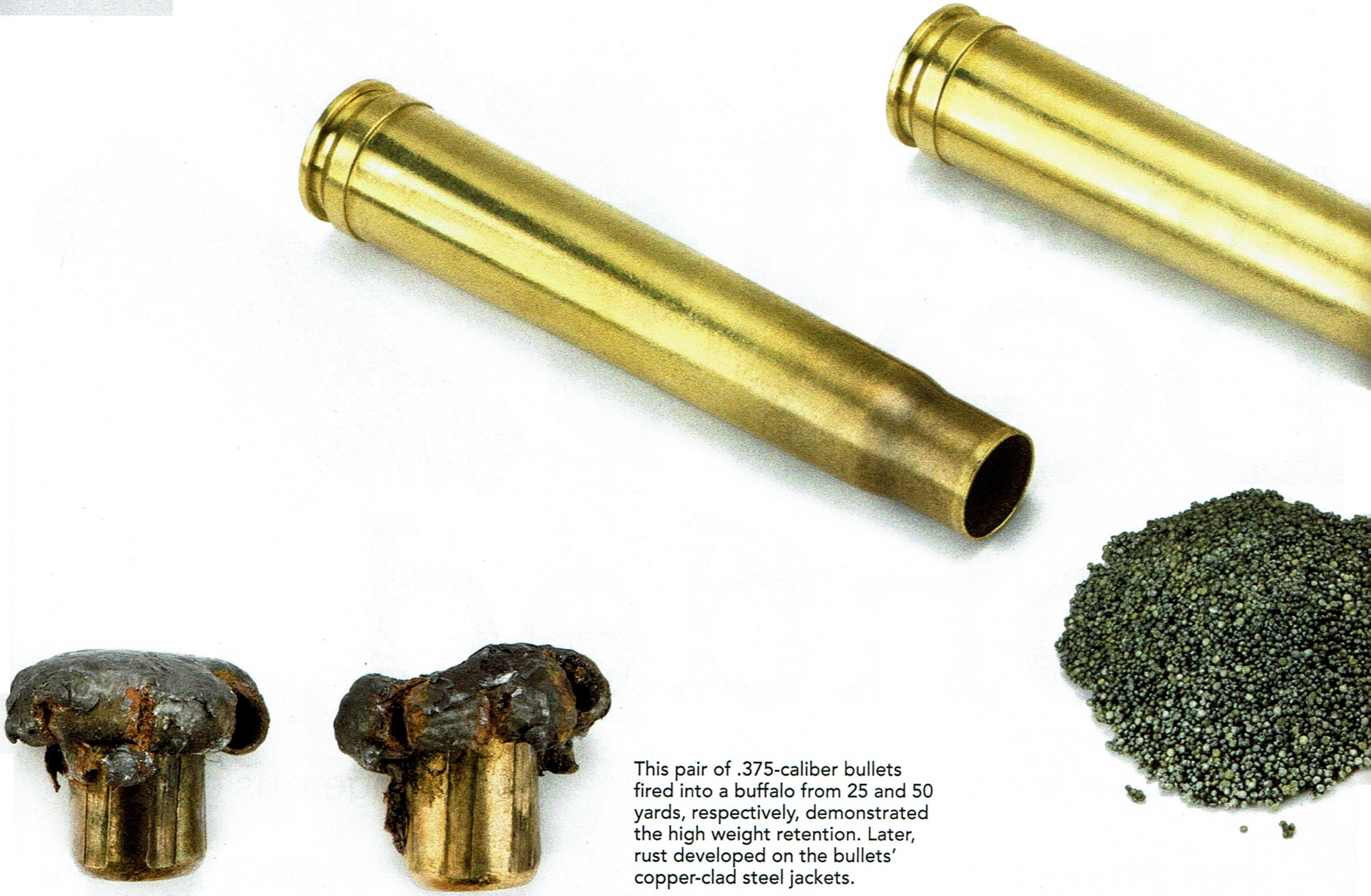
Big-bore bullet technology for the most dangerous game.

As I see it, the Dangerous Game eXpanding (DGX) Bonded bullet is a milestone for Hornady. It represents the culmination of everything that's been learned about hunting the world's largest species for generations and the blend of Hornady's state-of-the-art engineering. If guides and hunters had access to the DGX Bonded bullet during the age when the .375 H&H's reputation was being formed, perhaps other larger cartridges may not have been invented. Regardless of caliber, we have better options than hunters of centuries past.

Since 2007, Hornady has been in constant development of its dangerous-game lineup. Borrowing from the knowledge acquired from generations of legendary sportsmen and fueled by their own passion for such experiences, Hornady has risen as a leader in this segment with its Dangerous Game Series (DGS).

Ten years ago, similar bullets lacked the bonding now standard in Hornady's DGX line. These bullets span from .375 to .510 inch in diameter. As attested to by many – to include *Guns & Ammo's* Craig Boddington – poor "softs" often fragment during expansion after penetrating hair that covers a thick leather hide and dense bone. The majority of these animals are found on the African continent, but Hornady's latest bullet has proved itself on large game such as bears and moose across the Northern Hemisphere.

Bullet failure during a dangerous-game hunt has gotten many people injured and a few killed. In some instances, it's not the hunter who is hurt by an animal with a predisposed temper but the guide or trackers. Though the experience can be intense, it's the hunter's job to be ready to shoot effectively when the moment calls for it. Therefore, choosing the right bullet for use on dangerous game is a matter of great responsibility.



This pair of .375-caliber bullets fired into a buffalo from 25 and 50 yards, respectively, demonstrated the high weight retention. Later, rust developed on the bullets' copper-clad steel jackets.

In 2006, Mike Schoby was on a hunt in Zimbabwe for Cape buffalo when a soft bullet was shredded after passing through the shoulder. Its fragments did little to damage the buff's vital organs, which led the guide and trackers on a perilous stalk following a blood trail through tall grass. Minutes later, they startled the wounded buffalo, which turned and charged from 10 yards. Unfortunately, the raging bovine wasn't stopped until it was shot and killed with solids.

Dangerous-game hunting is serious business, more so in cases where bullets fail to perform. But it doesn't have to be. A combination of preparatory training, fitness, the right rifle, and ammunition will provide today's thrill-seeking hunters a collection of unrivaled memories.

Do you need a bigger caliber? It has been well storied that former *G&A* gunwriter Jack Lott sustained injuries from a wounded Cape buffalo in Mozambique in 1959. He had been hunting with a .458 Win. Mag. and concluded that a more powerful cartridge was required for dangerous game. He spent decades developing the .458 Lott, and A-Square became the first commercial manufacturer of it in 1989.

The .458 Lott was based on a modified .375 H&H cartridge, which is regarded by some African professional hunters (PH) as the minimum to hunt buffalo with. Still, many PHs prefer cartridges whose caliber starts with a number "4." While interviewing several PHs and hunters during the last two years, I've learned that the .375's reputation as an adequate caliber for dangerous game largely stems from bad experiences involving poor shot placement and the use of solid bullets for the first shot. Before the 1990s, solids of various metals were too often the only option available to these hunters. Solids are better at penetrating to the vitals of tough animals, but the effectiveness is limited by their expansion and placement. Softs, on the other hand, have a reputation of deforming too early or tearing apart when scraping past bone and piercing dense muscle.

PH Rex Hoets guided *G&A's* Editor Eric R. Poole for seven days chasing bulls of a different herd before the author had the opportunity to bring down this Cape buffalo. Like chasing old buffalo, shooting one can lead to unpredictable results.

Hornady offers solids in its DGS line, which should accompany a hunter's loadout of DGX bullets.

Big-game hunters sometimes prefer to load a rifle with a round or two of softs for their expansion followed by a round or two of solids for situations that turn scary where penetration is a must. In fact, PHs and experienced hunters surveyed in my travels arranged solids and softs for intuitive access along their ammunition belts or inside cartridge wallets worn on the hip.

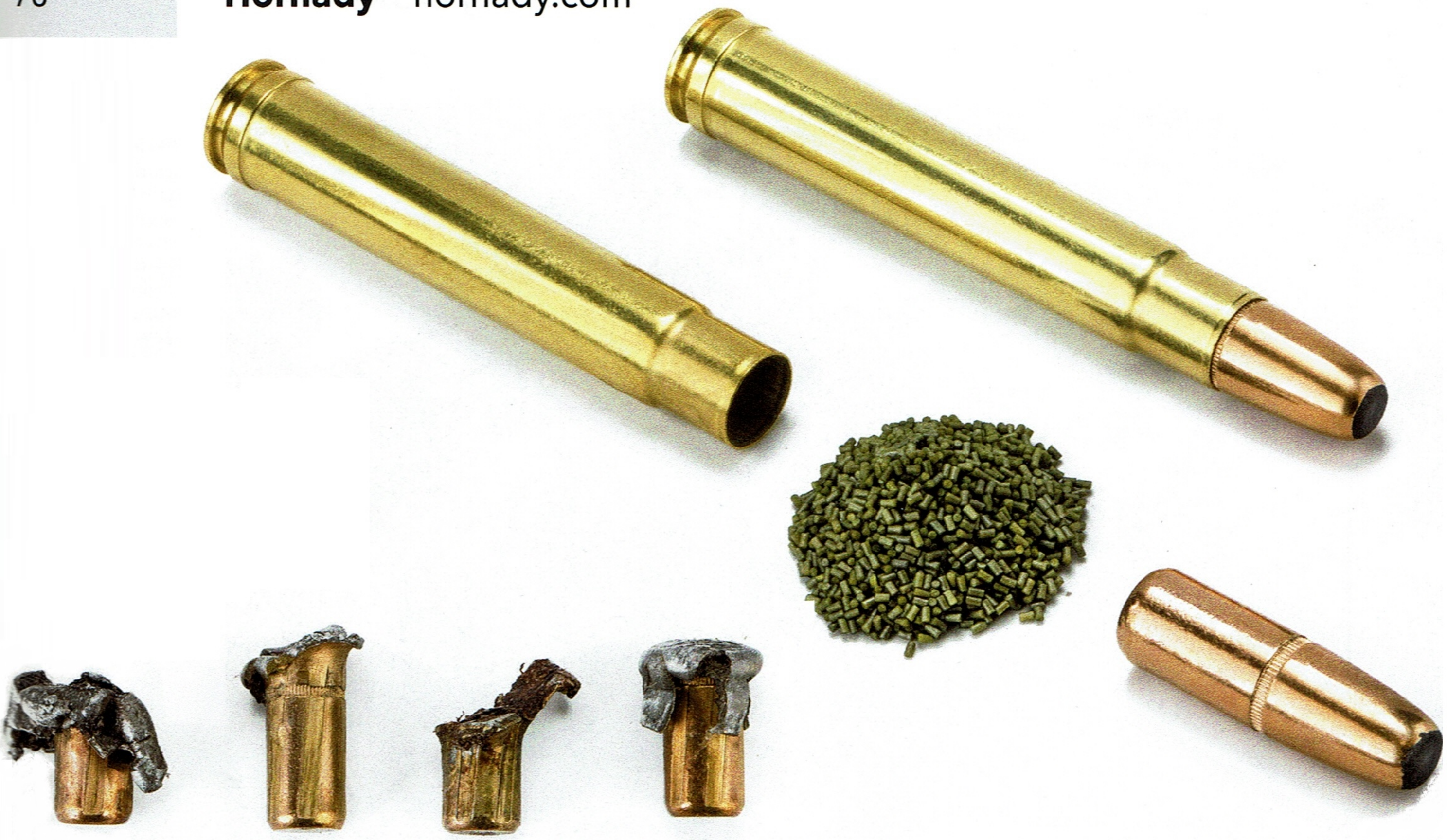
Bonded Magic

Being that Hornady's latest DGX bullet is bonded, it acts as if it were a hybrid in my opinion. With weight retention near 95 percent measured from recovered bullets in *G&A's* field tests, the DGX rivaled the retained weight of our tested solids and exceeded that of conventional softs. Additionally, each DGX projectile's profile mimics that of the corresponding solid for similar external ballistics. However, the DGX expanded on average between 1½ to two times the original diameter just as Hornady advertises.

The DGX bullet is based on a lead-core design that's now bonded by a proprietary process to the bullet's copper-clad steel jacket. I've asked different Hornady representatives several times what the secret sauce is that's bonding the bullet beyond the obvious mechanical engineering. It's no surprise that they refused to reveal details about their bonding process. After recovering nine of my own bullets from various big-game species, I can confirm one thing: It works.

Proving the Bullet

In 2016, I joined Neal Emery for a buffalo hunt with Chifuti Safaris and carried Kimber's Talkeetna in .375 H&H loaded with Hornady's new DGX Bonded ammunition. Emery carried the same bullet for his .375 Ruger, a brilliant rimless cartridge that offers increased case capacity over the H&H and modern case design. Developed in partnership between Hornady and Ruger, the .375 Ruger's case features a tapered body and sharper shoulder than the .375 H&H.



These recovered bullets from a buffalo shot with Hornady's 400-grain DGX bonded bullet in a .416 Rem. Mag. illustrate what happens when it impacts bone versus tissue.

The hunt took us to the Nuanetsi Conservancy of southern Zimbabwe, a region known for large leopards and a variety of plains game. PH Rex Hoets was our guide who tirelessly worked to identify fresh spoor in the morning and pursued tracks of the oldest buffalo that usually trail a herd (i.e., "dagga boys").

For seven days, Hoets and I stayed on track of herd bulls until two lone dagga boys and a cow unknowingly approached from the direction we were heading. From less than 25 yards on sticks, I fired a single DGX bullet into the forward shoulder of the bigger male while it was on the move. It fell dead 20 yards later. Hornady's DGX performed flawlessly. Subsequently, I hunted several other species of large plains game with consistent one-shot results. Three days later, an exhausted Emery managed to stop another old bull with his .375-caliber DGX bonded bullet, which was placed precisely under a horn and through its skull.

Compared to other cartridges whose names start with "4," the .375s remain the most recoil-friendly choices for shooters.

And the .416? PH Mark Gemmill guided my 2017 return to Zimbabwe for buffalo with Charlton McCallum Safaris (cmsafaris.com). He believed a rifle chambered for .416 is the best for hunting any game found in the world.

What sounded like an ambitious statement began challenging my predetermined conclusions as I listened to him describe other hunts.

"If I have a client having a hard time finding a mature bull, and they want to shoot a small animal such as an impala, we can take a break and do that," Gemmill said. "The .416 will cleanly take smaller animals without damaging their beautiful hides. And, if we're cornered by something that wants to hurt us or eat us, the .416 can stop that, too."

Almost like the .375, the line of Hornady's .416 cartridges span the classic Rigby loading to the more efficient Ruger cartridge. Additionally, there is a .416 Rem. Mag., which is available in a variety of platforms.

Following the success in 2016, I returned to Zimbabwe with an elegant Kimber Caprivi in .416 Rem. Mag. to hunt buffalo in the northeast corner along the Zambezi river that borders Mozambique and Zambia.

Hornady's .416 DGX bonded bullet weighs 400 grains. Felt recoil was very manageable in the Caprivi, and three-shot groups yielded several three-quarter-inch results at 100 yards.

The .416 Rem. Mag. is a belted case with a bottleneck that borrows its case from the 8mm Rem. Mag. (its parent). Though initially expected to replace the .416 Rigby, its introduction in 1988 renewed interest in the .416 caliber, which eventually led to the partnership between Ruger and Hornady that created

This wide buffalo bull, hunted in Zimbabwe's northeast corner, stubbornly fought being taken by the author's .416 Rem. Mag.

the .416 Ruger in 2008. Performance between the .416 Rem. Mag., Rigby and Ruger seem to mimic one another, and each offers certain advantages that have more to do with comparing rifles than chambers. The DGX bullet in each load features the same 400-grain bonded, copper-clad, steel-jacket lead core.

To hunters looking to hunt the largest of dangerous-game animals, the .416 cartridges are most often preferred among Africa's PHs for their clients. They have a reputation for effectiveness and manageable recoil in field situations. As Boddington advises, "A dangerous-game hunter needs to keep shooting, reloading, and shooting until the animal goes down and doesn't get up." For that, you had better be able to stay on target, fire, recover from the felt recoil, and shoot again.

I heeded Boddington's advice while hunting Zimbabwe's Dande communal land. On the morning of our fourth day, Gemmill and his keen-eyed trackers located a mature, wide bull in a small herd that led to a stealthy stalk to circle ahead of the group and to avoid being winded. On sticks, I felled the buffalo on the first shot with a well placed DGX bullet clipping the heart and entering its lungs. Unbelievably, the bull attempted to stand and fight as I rechambered and continued firing and loading five more times until he bellowed a deep, guttural death groan.

The Last Shot

While the .416 should have killed that bull as effectively as the .375, my years of hunting remind me that the determination of the animal being hunted and our ability to damage vital organs are the most important factors that affect success. You can do your part in picking the gear and practicing for the shot, but a stubborn buffalo often has a say in whether or not it goes down without a fight. That's the allure of dangerous-game hunting.

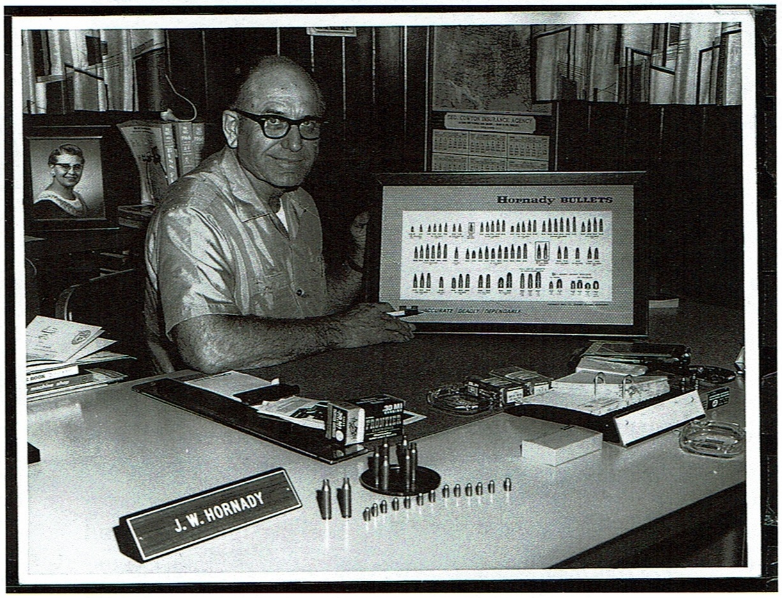
Once you've hunted an animal that can kill you, you change. There are few adventures in a person's life aside from combat or extreme sports that equate to the experience enjoyed by dangerous-game hunters. And each of these can have the same effect. If you survive with a certain mindset, a part of you will always crave the pursuit again.

Peformance	Velocity at Muzzle (fps)	Velocity at 100 yds. (fps)
.375 H&H Magnum 300-gr. DGX	2,530	2,223
.375 Ruger 300-gr. DGX Bonded	2,660	2,344
.416 Rem. Mag. 400-gr. DGX Bonded	2,400	2,142
.416 Rigby 400-gr. DGX Bonded	2,415	2,157
.416 Ruger 400-gr. DGX Bonded	2,400	2,143
.458 Lott 500-gr. DGX Bonded	2,300	2,028
.458 Win. Mag. 500-gr. DGX Bonded	2,140	1,871
.470 Nitro Express 500-gr. DGX	2,150	1,885
.500 Nitro Express 3-in. 500-gr. DGX	2,150	1,881

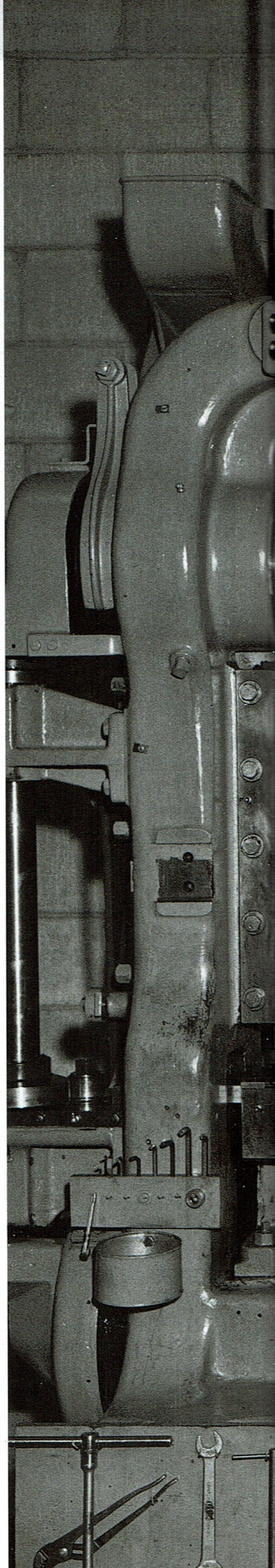
Three Generations (and Counting) of Bullet Making

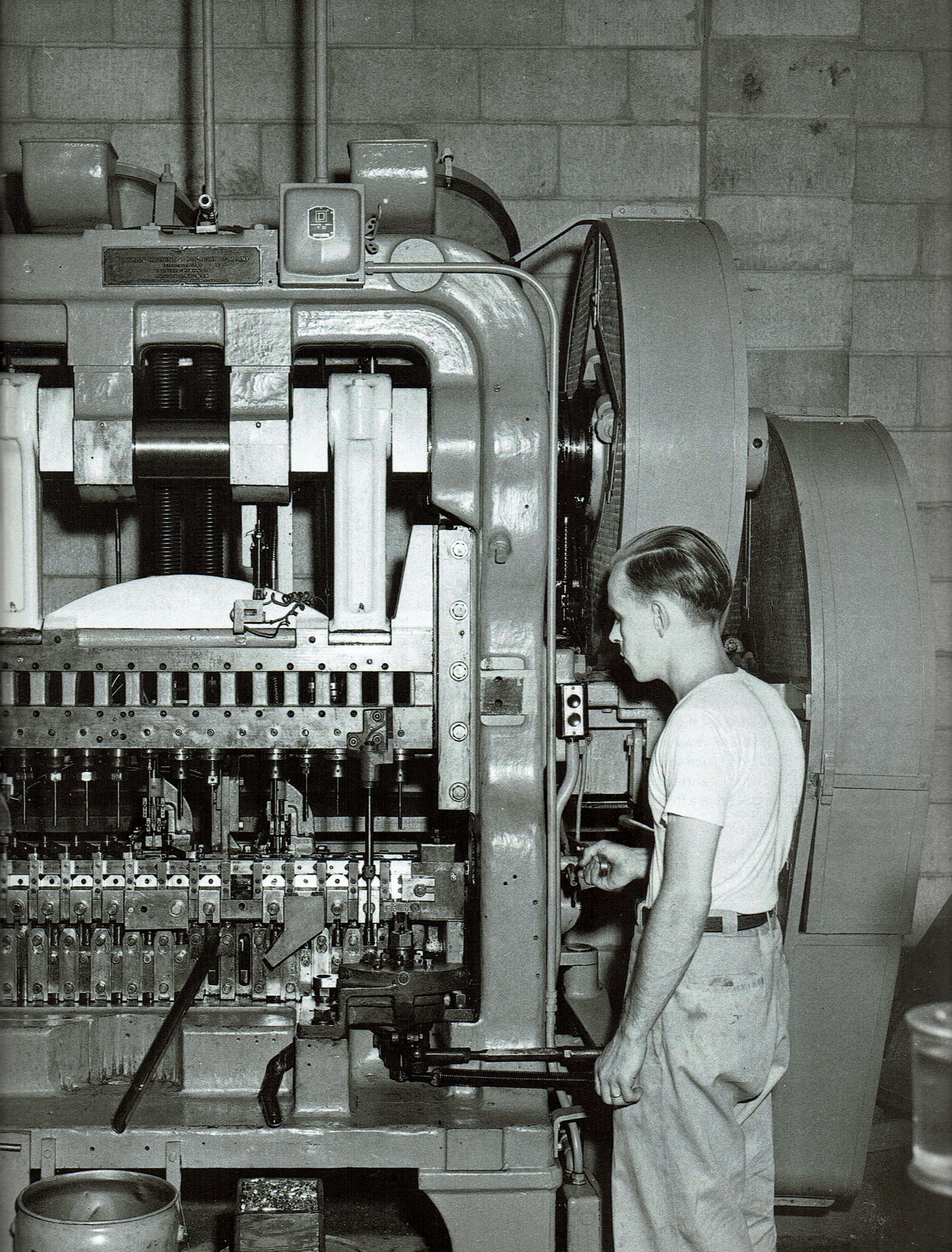
By Joe Arterburn

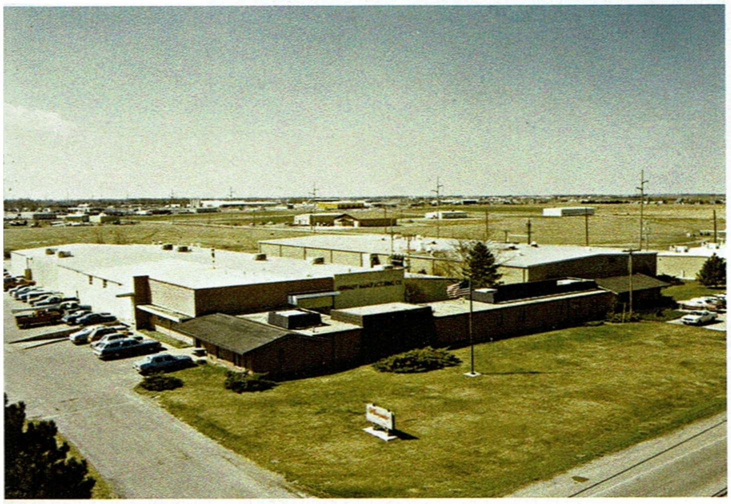
A conversation with the Hornadys.



On New Year's Day in 1981, Jason Hornady's mother, Cheryl, received a kidney transplant. With Cheryl still hospitalized, Jason's father, Steve, decided not to join his father, Hornady Manufacturing founder Joyce Hornady, company engineer Edward Heers, and customer service manager Jim Garber, who were traveling to New Orleans to pitch their ammunition line at the Shooting, Hunting and Outdoor Trade (SHOT) Show, an annual outdoor-sports industry convention. On January 15, the company plane crashed due to a mechanical failure just short of the New Orleans runway. All three were killed.

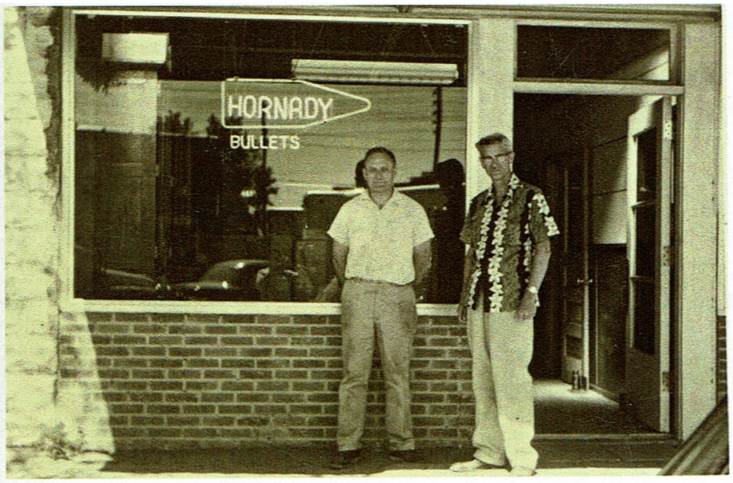



BUILT BY
FRANKLIN MACHINE & FOUNDRY COMPANY



The Hornady Manufacturing plant is located in Grand Island, Nebraska. From a small family business to employing more than 300 people, Hornady has stood the test of time and generations.

Circa 1954 Joyce Hornady, left, with a customer in front of his first sporting goods store. The store sold everything from basketballs to hunting products.



Steve questions if somehow something would have been different had he been on the plane.

"I don't know if me being there would have changed circumstances ... that it might not have happened that way," he said. "Who knows?"

Jason sees it differently. Had his father been on that plane, he said, "We would not be talking here today."

"Here" is his office in the 145,000-square-foot Hornady ammunition-manufacturing facility in Grand Island, Nebraska, down the hall from his father's corner office at the front of the building.

"I absolutely love it here," Jason said. "I've walked around this place since age three. I knew at that age this is what I wanted to do." Not that the Hornady name gave him a free pass.

"I told my kids if they wanted to come into the business, there'd be a job for them but not until they are 30," said Steve. "I told them to go do something. I'd love to have them come back, but what I want them to do is have a happy life. That's all you can hope for your children. I'm not trying to build a dynasty, something that will live on for decades after I'm gone."

But he's glad Jason is back, after working as a sales rep and a sales manager in the outdoor industry for more than 15 years.

"Of my sisters, Meighan and Elizabeth, and cousins, I happened to be the one to pursue coming back," Jason said.

"I was past the threshold Dad had set, and we talked once in a while about my coming back. It got serious a couple times but usually got unserious when we talked about the pay cut I'd have to take. Then there was an opening in sales and marketing, and my daughter was a year away from starting school. My wife, Ellen, said to us one Fourth of July, 'You two better figure this out because once our daughter starts school, I'm not moving.' So I took a 50-percent pay cut and came back." That was 2006.

The Dynamic Duo

Steve and Jason have similarities and differences. Both are quick to smile, quick to joke. Steve has a wry, quiet sense of humor; Jason's is more obvious, more out front. Steve has a close-cropped gray beard; Jason sports stubble. They both have dogs rescued from shelters. Steve reads magazines and Jason books. They both list the Clint Eastwood movie *Unforgiven* as a favorite. Steve can quote dialogue from it, a lot of lines. They both mention mule deer hunting as a favorite. They are competitive. Jason says his dad is a better rifle shot, but "put a shotgun in our hands, and I'm going to whip him." Steve says he is "a fairly adequate rifle shooter," but, yes, Jason can beat him now in shotgun, "which pisses me off."

"When I shot trap with my dad, I had the advantage of younger eyes, reflexes, and stamina," Steve said. "I knew Dad was frustrated, not that I was beating him, but because he wasn't doing better. Now I know exactly how he felt."

They both like talking to customers, friends, fellow shooters, hunters, and, especially, employees whom they consider family. Employees receive annual retirement and cash bonuses equal to a third of their salary. All employees – janitors, line workers, executives – receive the same percentage.

Steve said he can still run a couple machines on the floor, but most are computerized now and beyond him. "Oh, I could learn," he said. Jason holds up

his hands. "They don't let me touch anything with a motor," he said. "The joke is these [waggling his fingers] are for typing and dialing. If you want to see a machine shut down, just let me near it."

"Jason has always been a natural people person," Steve said. "Even as a little boy, he'd be talking to people. He wasn't shy or hanging on his mother's skirts. He was never like that. He was always out front, and that has stood him well and is good for our company."

Jason said Steve is "so intelligent it makes me mad sometimes. He's pretty sharp. We'll start talking about a situation with machines or delivery or how to sell something, and he'll just throw something out, and I'll go 'How did you know that?'"

"He's a good guy. He comes across as gruff and cranky, but in the end, he cares more than he'll let you know. He'll argue with a stump, and he'll argue that he doesn't like to argue."

"But, he's never fired me. I've quit a couple times, but he doesn't know I quit, and he's probably fired me a couple times I don't know about. In general, we have a pretty good time. We don't always see eye to eye; he thinks I spend money like it's from a money tree out back…." Smiling, he stops himself.

A Family Affair

Family is deeply rooted, living just under the surface. Asked to share a favorite story about his father, Steve's usual ebullience drifts away. There is a long pause. He takes a deep breath. "I don't know," he said, quietly. "That's a hard one to answer." He paused, thinking. "We had good times. We were friends, even though we had some knockdown, drag-out fights. I'd be arguing about something I thought we ought to be doing, and he'd laugh and say, 'Well, I must have done something right.'"

"I'd tell him, 'You're the CEO. You can tell people what to do,' and he'd go – and this phrase drove me crazy – 'A man convinced against his will is of the same opinion still.' At the time, I didn't appreciate it a bit; today I do."

Notable Hornady Milestones

Developed original machine that drew bullet jackets from spent .22-caliber casings, then formed finished bullets, when other companies used multiple machines.

Secant Ogive – Developed by U.S. Army ballisticians, this aerodynamically efficient bullet configuration became a signature profile of Hornady bullets.

InterLock Bullets – Outer jacket features a ring embedded in the bullet core, ensuring the core and jacket are locked in one piece during expansion to retain mass and energy.

XTP Pistol Bullets – Handgun bullet popular with hunters and target shooters because of accuracy and performance.

A-MAX, V-MAX, Z-MAX – Polymer-tipped bullets for hunting, varminting, and putting down zombies.

LEVERevolution – Polymer tip allows use of aerodynamic bullets in tubular magazines. Lever-action aficionados are still giving a standing ovation.

TAP – Tactical ammunition designed to deliver reliable and consistent performance.

Critical DUTY and Critical DEFENSE – Feature-rich law-enforcement and self-defense ammo, respectively, with polymer-filled hollowpoint for improved performance.

.17 HMR – Wildly successful rimfire ammo developed by necking down .22 Magnum case to take a .17-caliber bullet; it delivers varmint-punching flat trajectory.

6.5 Creedmoor – Developed as the first factory-loaded match cartridge, it evolved to bring precision-based performance to hunting.

ELD-X and ELD-Match – Featuring heat-resistant tips that don't melt or deform in flight, promising improved long-range accuracy.

Jason was 10 when his grandfather died. "I remember him as soft-spoken, very mechanically inclined," Jason said. "I remember I'd be his wadfeeder, putting wads in his shotshell reloader. If I missed a wad, shot would go everywhere, and he'd mutter." His grandfather, called "Poppy," also gave him rides on the front bar of his Schwinn three-speed bicycle. He didn't drink or swear, but Jason remembers being at bat during a little league game, "about to strike out for the fourth time," when from the stands he heard his grandfather yell, "Hit the damn ball."

What would Joyce think of Jason today? "He'd shake his head at my style," Jason said. "There's a company rumor that when he was really involved in sales, he put K-Mart on hold. No one put K-Mart on hold. I'm more about sales and promotion than he would have preferred, but he'd be impressed how much stuff we make."

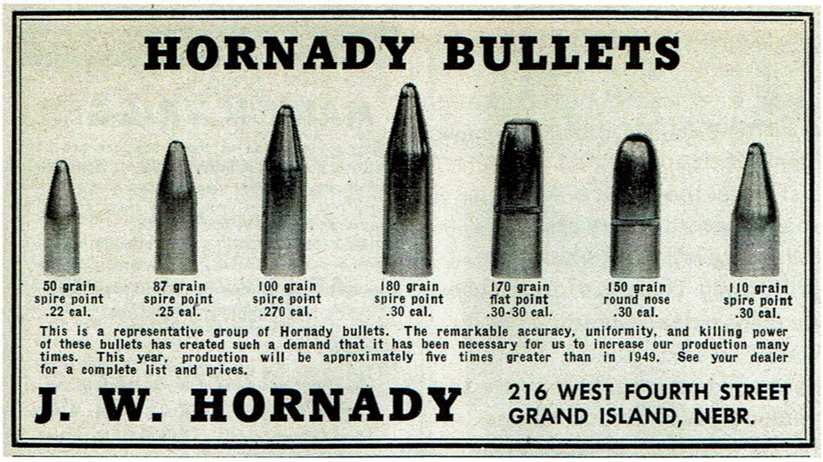
Steve called his dad "semi-unflappable."

"I never saw him get worked up or particularly distressed," he said. "He had supreme confidence in himself. Not arrogance – he was just confident he would work it out."

Steve and Jason talk proudly of the past. Tears welling in his eyes, Jason reached for a tissue. "I apologize," he said. "I get emotional when I talk about this stuff."

Steve sits in his father's chair in his father's office, the far wall a map of the world, a zebra hide on the floor, awards and trophies on the wall, including some of Steve's "two and quarter" Grand Slams of sheep. (Many of Joyce's hunting trophies are displayed in the atrium, as are Steve's. Jason "is starting to squeeze some in here and there.") A framed photograph of Joyce hangs behind the desk. "I make sure I have him looking over my shoulder to remind me from time to time, 'Don't get too big for your britches, boy,'" he said.

The first year in business saw $10,000 in total sales. Later, they would add a 200-yard underground range and invent a bulletmaking machine the world had never seen.



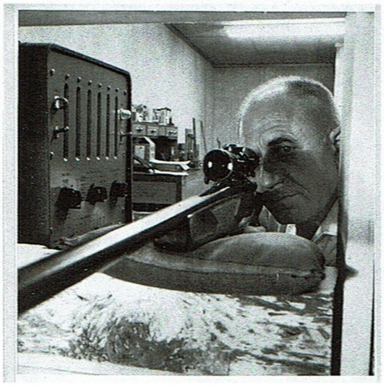
HORNADY BULLETS

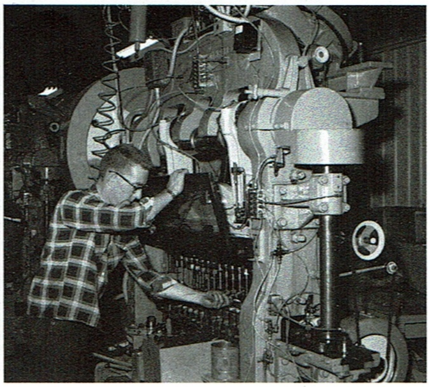
50 grain
spire point
.22 cal.
87 grain
spire point
.25 cal.
100 grain
spire point
.270 cal.
180 grain
spire point
.30 cal.
170 grain
flat point
.30-30 cal.
150 grain
round nose
.30 cal.
110 grain
spire point
.30 cal.

This is a representative group of Hornady bullets. The remarkable accuracy, uniformity, and killing power of these bullets has created such a demand that it has been necessary for us to increase our production many times. This year, production will be approximately five times greater than in 1949. See your dealer for a complete list and prices.

J. W. HORNADY

216 WEST FOURTH STREET
GRAND ISLAND, NEBR.



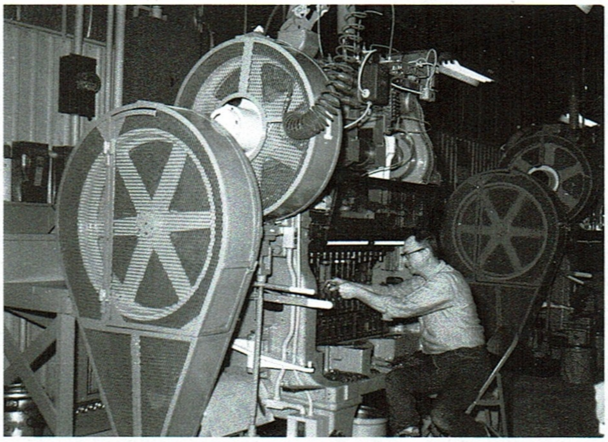


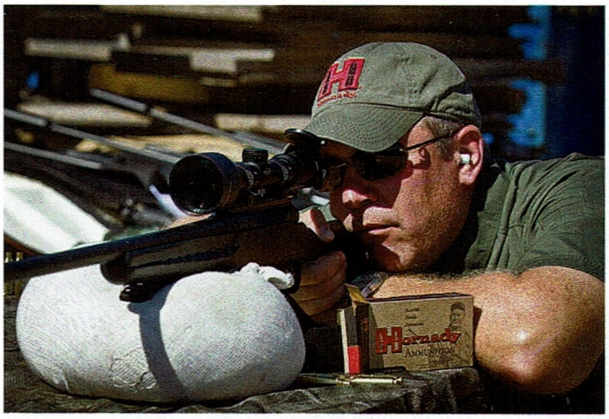
A Legacy Continued

The crash was a staggering blow, the cause never fully determined. Both Joyce and Ed Heers were pilots, but no one knows.

Hornady Manufacturing was founded in 1949 because Joyce, a hunter and avid pistol shooter, believed he could produce ammunition with better performance than military surplus rounds used by sportsmen after World War II.

During the war, Joyce, too old for active service, was a marksmanship instructor for the National Guard training unit at the Cornhusker Army Ammunition Plant (six miles west of the Hornady facility). After the war, he opened a sporting goods store and reloaded practice ammunition for the Nebraska State Troopers in his basement.





Always in search of more accurate ammunition, Joyce and Vernon Speer, machinist friend and fellow competitive pistol shooter, who later founded Speer Bullets, converted a salvaged Linotype press into a machine that could redraw bullet jackets from empty .22-caliber cases and then form finished bullets.

Joyce's father, Harvey, a Methodist pastor, died when Joyce was three. His mother, Mary, raised Joyce and his siblings, Frances and Keith, all named after prominent Methodists of the day. As soon as they were old enough, the Hornady children pitched in by working newspaper and milk routes. In 1930, Joyce met Marval, then working at the University of Nebraska in Lincoln. Joyce was selling dental supplies. They married in 1934. "He was always a salesman and a good one," Marval said in a 1998 interview.

Joyce earned his pilot's license at age 55, telling Marval he'd always wanted to fly. Flying expanded Joyce's hunting range: Alaska, Lower 48, and Canada. Then came the accident.

A friend offered to run the company, but Marval said no. Would she agree to community leaders heading the company? No, she said, the family will run it. The family and company regrouped. Steve, who had joined the company in 1970, became president; his sister, Margaret, became vice president; Margaret's husband, Don David, became chief engineer. Marval, called "Baba" by grandchildren and great-grandchildren, was chairman of the board. She worked until age 90, ultimately handling insurance matters for employees. "She was defender of all," Jason said. "She wouldn't hesitate to take up the fight for anyone in her flock." She died in 2015 at age 102.

Joyce's motto was "Ten bullets through one hole." How will Steve be remembered? He said: "If anything, 'He built on the legacy of the family and helped guide the company into the next era.'" Jason takes a lighter approach: "I want my tombstone to read, 'He was fun in hunting camp.'"

There's a fourth generation in the wings. Years ago, Jason asked daughter, Abby, what she wanted to do when she grew up. She said, "I want to run sales and marketing at Hornady." He then asked his son, Alex, what he wanted to do. He said, "Work for her." Abby has since gone through a progression of career ideas. Alex, a shooter in his own right, is pretty sure he wants to work there.

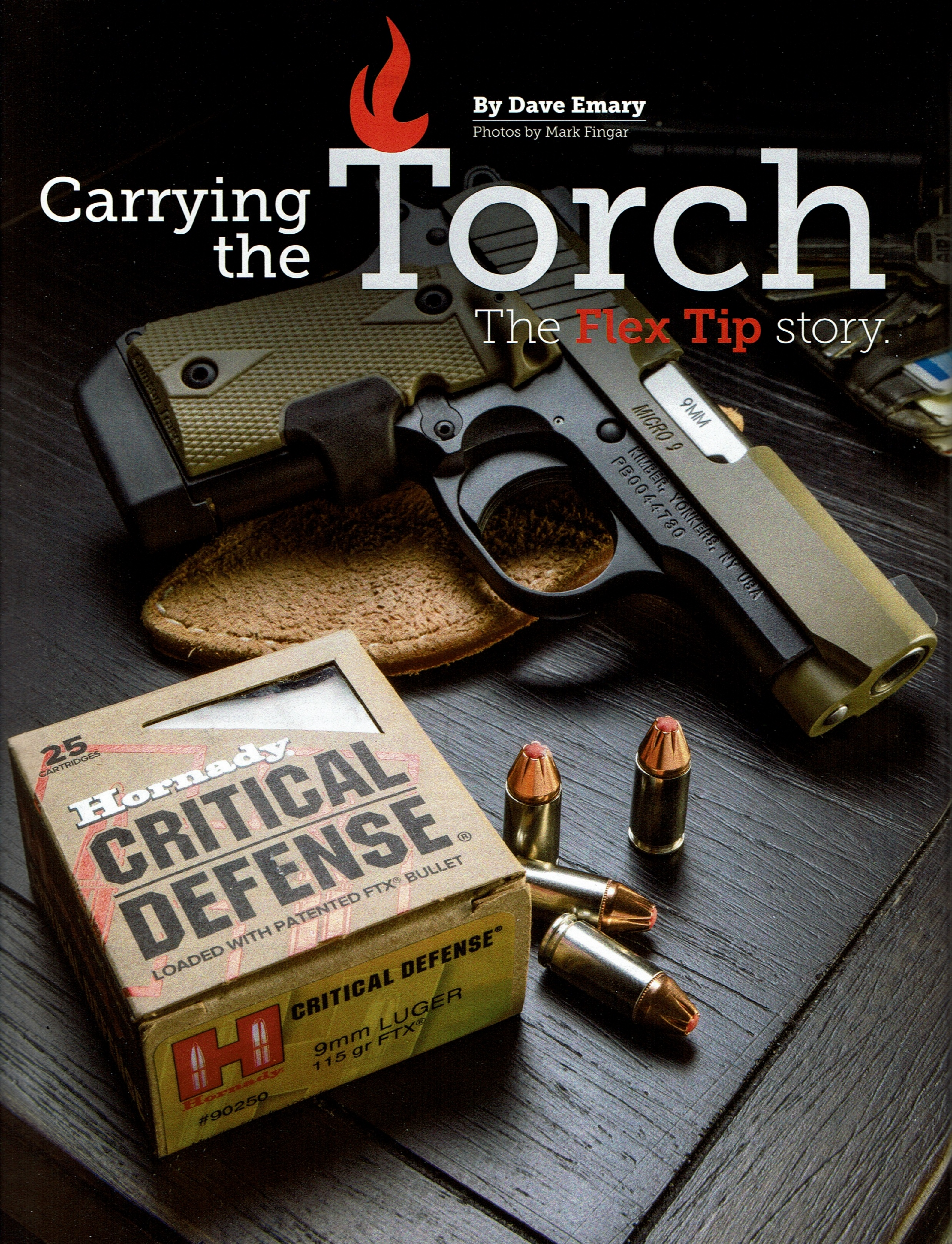
Whatever their choice, they'll get this message: Not until you're 30. H

By Dave Emary

Photos by Mark Fingar

Carrying the Torch

The Flex Tip story.


9MM
MICRO 9
KIMBER, YONKERS, NY USA
PB0044780
25 CARTRIDGES
Hornady
CRITICAL DEFENSE®
LOADED WITH PATENTED FTX® BULLET
CRITICAL DEFENSE®
CRITICAL DEFENSE
9mm LUGER
115 gr FTX®
Hornady
#90250

Sometimes, during the development of new ideas and technology, it can take a long time to get from a proof of concept to something that can be successfully mass produced. This is certainly the case with what is now a standby product for Hornady, the Flex Tip.

In the 1990s, there was serious competition among ammunition manufacturers to develop a bullet to win the FBI contract for pistol ammunition. This contract is awarded about every five years based on a scoring system called the FBI Protocol. The FBI developed the Protocol and scoring system in the late 1980s to evaluate projectiles and grade them based on six tests of real-world conditions. The Protocol involves shooting bullets into gelatin through a number of urban barriers.

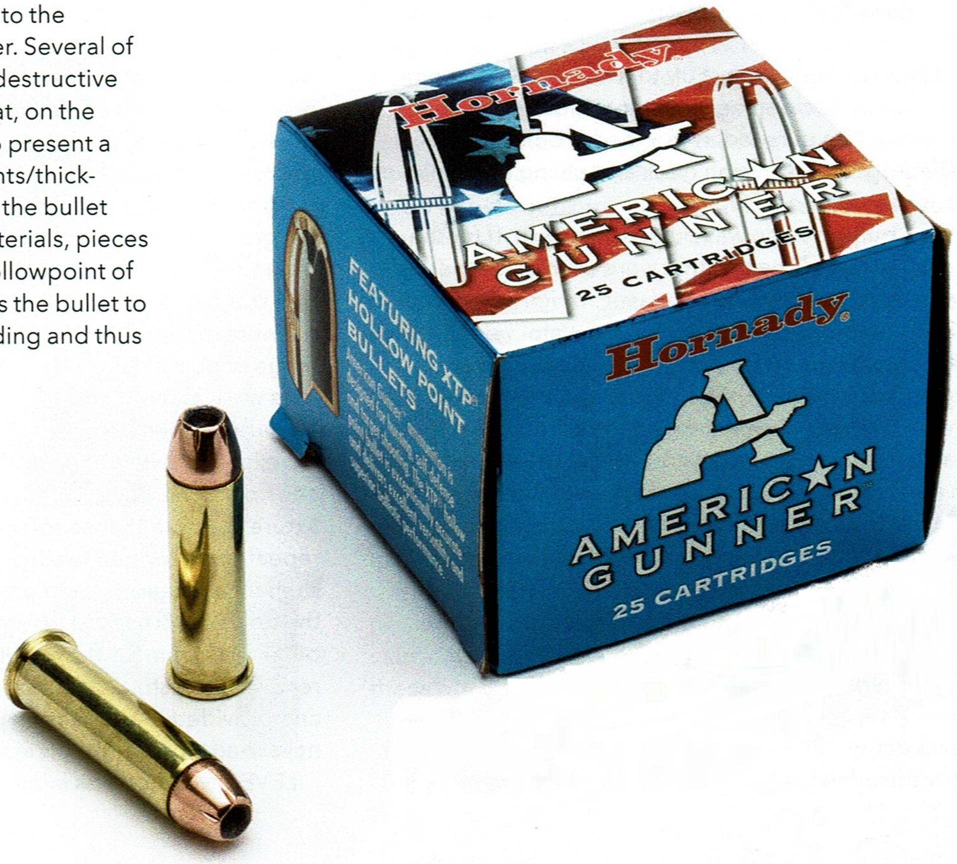
The performance expectation was bullets that would penetrate at least 12 inches but not more than 18 inches in gelatin after passing through these barriers. In essence, the FBI wanted bullet performance blind to the barriers. That is a tall order. Several of these barrier targets are destructive to bullets. One barrier that, on the surface, wouldn't seem to present a problem is various amounts/thicknesses of clothing. When the bullet passes through these materials, pieces clog or fill up the large hollowpoint of a pistol bullet. This causes the bullet to act like a FMJ, not expanding and thus over-penetrating.

A number of bullet designs were introduced that substantially improved hollowpoint bullet performance in many of these barriers. Most relied on jacket bonding, but all were hollowpoints and suffered from the clothing clogging problem. Hornady began initial work in 1999 to try and solve the clogging problem as a starting point for developing their own version of a pistol bullet to meet the FBI Protocol.

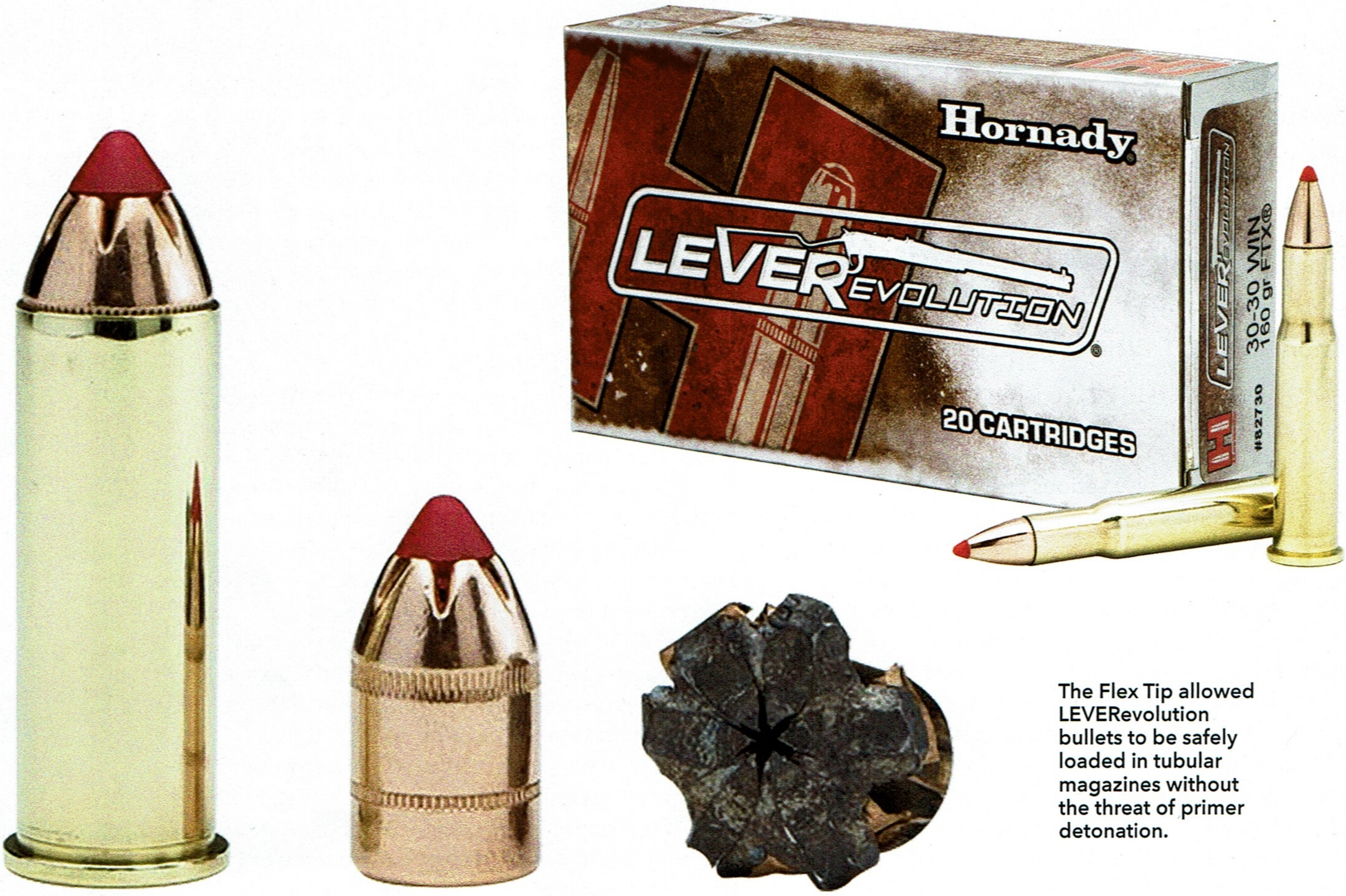
The Origins of Flex Tip

In April 1999, the idea was suggested that if the hollowpoint could be filled with a material that would prevent clogging but still be flexible enough to provide expansion, this could be a solution. The idea was to pre-fill the hollowpoint with something that approximates the target material. Some .45-caliber, 230-grain XTP bullets were modified by literally going to the home improvement store, purchasing silicone caulk, and filling the hollowpoints with it. The performance results were eye-opening. Not only did it solve the clogging problem, but the expansion of the bullet was greater and started sooner.

The proof of concept was shown. How to put this into a form that could be mass produced was another thing. At this point, it was decided serious work would begin on a bullet design that would meet the FBI



Hornady's Flex Tip design was to pass the FBI Protocol for pistol bullets. Hollowpoint pistol bullets shown here have one weakness: If the cavity fills with clothing, expansion suffers and penetration increases. Flex Tip inserts prevent that.



The Flex Tip allowed LEVERevolution bullets to be safely loaded in tubular magazines without the threat of primer detonation.

Protocol rather than just try to "out-point" everyone else. It was decided early on that a bonded bullet would not be pursued as they had problems with reliably getting through glass and giving the minimum 12 inches of penetration.

The bullet design was pursued on and off for the next five years. The tips that were used in this period were the usual hard Delrin plastic, which never worked and inhibited expansion at the low pistol velocities. The search was on for a softer, more resilient polymer. About the start of 2004, a polymer supplier made Hornady aware of a new line of polymers that had properties similar to rubber that were available in a wide range of hardness/stiffness. This instantly piqued the creative juices. Initial tests showed a great deal of promise. At this point, the FBI bullet project got overtaken by other events.

LEVERevolution

I was heading up the FBI pistol bullet project at the time. As is generally known, I have a lot of interest in lever-action rifles and their ammunition. In early 2005, I proposed to Steve Hornady that these new materials would likely allow the use of a pointed lever-action bullet that would be safe in a tubular magazine. We would be able to get this product to market much quicker than a totally new pistol bullet. Off we went.

After calculations and discussions, we decided that the greatest threat for a tubular magazine detonation was much higher from a gun being dropped out of a tree stand than from recoil. Tips with the new material were made and put into pointed bullets, and the range of popular lever-action bullet weights and calibers were assembled with no powder but live primers. Magazine tubes from rifles, with follower and spring, were loaded with this ammunition and the receiver ends plugged. For a worst-case test, we made a drop fixture that was 15 feet above a concrete floor and repeatedly dropped loaded magazines to see if any primer detonation would occur. Early testing led to the decision to use the polymers from the harder end of the spectrum for the material. This material quickly recovered its shape once loaded into the chamber and provided the necessary primer cushioning. We never had a primer go off in hundreds of tests.

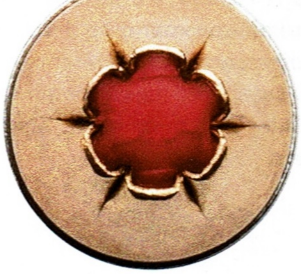
LEVERevolution was launched in 2005. This work

for the LEVERevolution product line and what would become the Flex Tip material is now history, and this is how it started. The LEVERevolution line has had a number of calibers added to it over the years, including several pistol calibers.

20 CARTRIDGES
Hornady
CRITICAL DEFENSE
LOADED WITH PATENTED FTX® BULLET
25 CARTRIDGES
Hornady
CRITICAL DEFENSE
LOADED WITH PATENTED FTX® BULLET

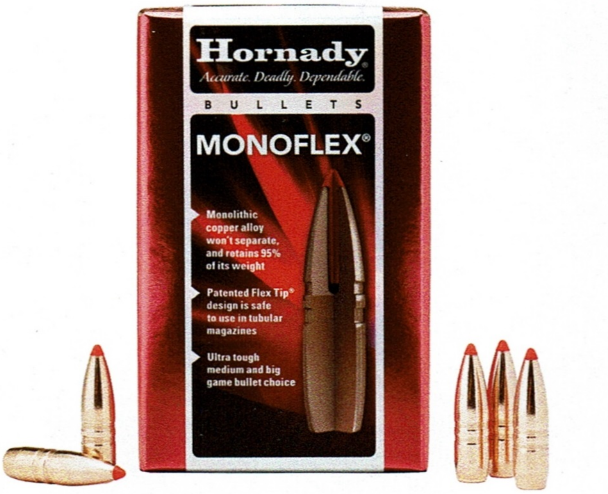
Critical Defense

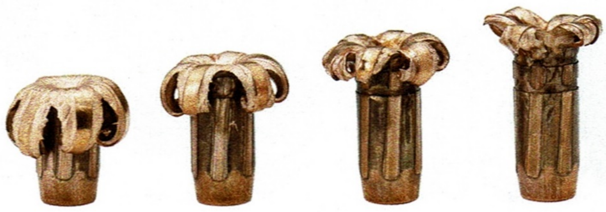
Hornady spent 2006 through 2008 expanding the LEVERevolution line when word came early in 2007 that Ruger was going to introduce a small .380 CCW pistol for 2009 called the LCP. This immediately hatched the idea at Hornady that, with the Flex Tip materials, they could make a superior .380 pistol bullet. This bullet would reliably penetrate clothing and provide effective expansion and penetration even with the low muzzle velocity from a small .380 Auto pistol. If it worked in the .380, it would have application in a number of other self-defense cartridges and loads.



Critical Defense bullets use Flex Tips to penetrate heavy clothing while maintaining rapid expansion and penetration.

The design of Critical Defense bullets was meant only for penetrating heavy clothing and providing rapid expansion and penetration that would keep the bullets inside a human target. For the lower muzzle velocity of typical self-defense loads in small, short-barreled handguns, testing showed that the softer end of the spectrum of the Flex Tip polymers worked the best. The Critical Defense line of ammunition was introduced in 2012. It has been expanded a number of times with more caliber offerings since then.

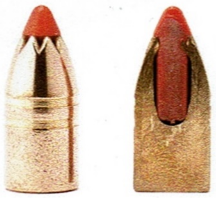

Hornady
Accurate. Deadly. Dependable.
BULLETS
MONOFLEX®
Monolithic copper alloy won't separate, and retains 95% of its weight
Patented Flex Tip® design is safe to use in tubular magazines
Ultra tough medium and big game bullet choice



MonoFlex

At this point, it was decided that a monolithic copper bullet with a Flex Tip would make a deep penetrating bullet for lever-action rifles. The Flex Tip material made it easier to initiate expansion of the solid copper bullets at lower velocities and extended the retained velocity expansion limit several hundred fps lower. The use of Flex Tip material in the MonoFlex lever-action bullets made a deep penetrating bullet for lever-action rifles that was safe for tubular magazines. The penetration of these bullets is substantial.

MonoFlex bullets benefited from Flex Tip technology, too, making for an excellent, deep-penetrating hunting round for lever-action rifles.



Hornady
Hornady
MONOFLEX ML
50 Cal. (.452) | 250 gr.
50 Cal. (.452) | 250 gr.

The MonoFlex line of bullets was launched in 2011. To test them, a buffalo hunt was booked, and a bull weighing over 2,000 pounds was taken with a 250-grain .45-70 MonoFlex load. A 1,600-pound bull was taken with a 140-grain .30-30 MonoFlex load. Both bulls were taken with one shot, and the bullets completely penetrated the animals. Several saboted muzzleloader bullets have also been added to the MonoFlex line since then.

Critical Duty

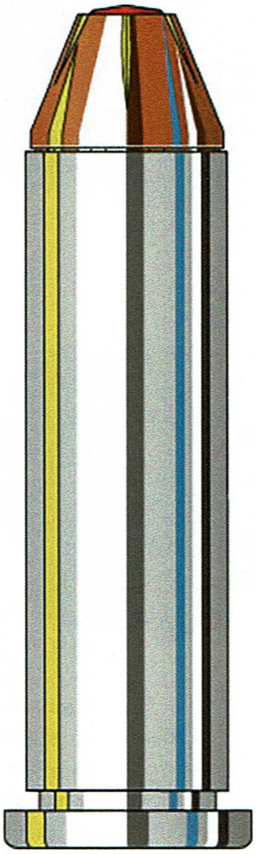
The FBI Protocol bullet had been put on a back burner once LEVERevolution and follow-up projects had started. Hornady worked on expanding the LEVERevolution and Critical Defense lines for 2009 and 2010. Lessons learned were percolating into the thinking about the FBI bullet.

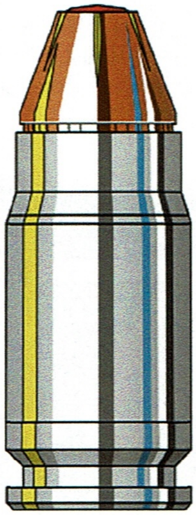
In 2010, a focused project began to design a bullet that actually met the FBI Protocol instead of winning on points. The Flex Tip was incorporated into the design, and it made a dramatic improvement to the performance of the bullet in five of the six barrier tests. The biggest hurdle was meeting 12 inches of gelatin penetration after being fired through glass. This took a great deal of time, hair pulling, and resets to ultimately solve. In the end, it was a rather elegant engineering solution, which is patented. The Critical Duty line was introduced in 2012 with 9mm, .40 S&W, and .45 ACP loads. The line has been expanded with new caliber offerings since then.

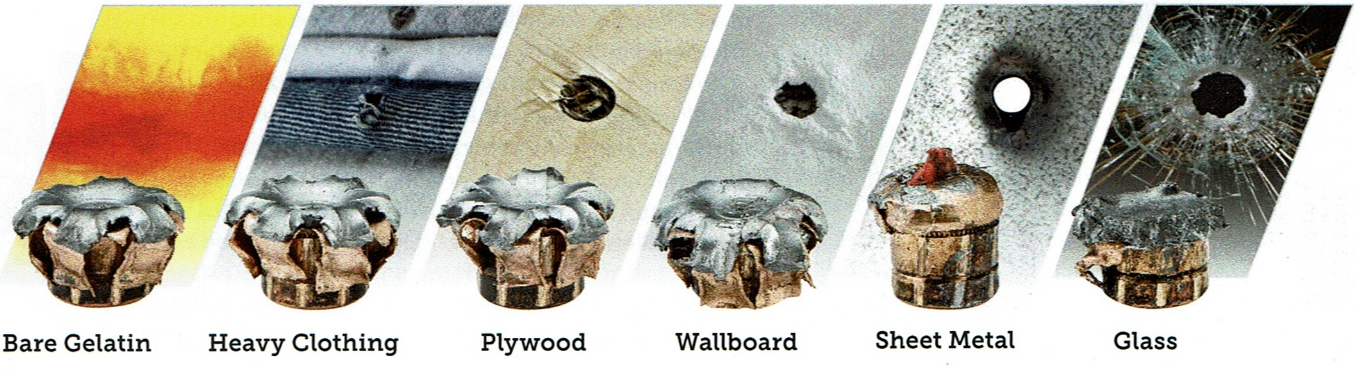
The Critical Duty line was the first and is still the only line of tactical pistol ammunition that meets the FBI Protocol of providing consistent post barrier penetration of 12 to 18 inches. Hornady

Hornady
CRITICAL
DUTY
25 ROUNDS
Hornady 25
CRITICAL
DUTY
CRITICAL
DUTY
9mm Luger

Utilizing Flex Tips, Critical Duty ammunition was the first line of tactical pistol ammunition to meet the FBI Protocol.







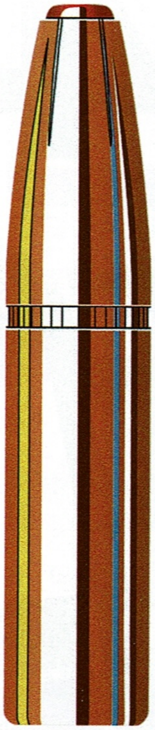
was recently awarded their third FBI handgun ammunition contract for the 9mm +P 135-grain Critical Duty ammunition featuring Flex Tip. The Critical Duty line is designed as a heavy-duty bullet to shoot through barriers and meet the FBI Protocol by being essentially "barrier blind." These bullets will penetrate significantly more than the Critical Defense bullets.

SUB-X

In 2020, Hornady introduced the SUB-X line of bullets and followed it up with an ammunition line. The bullets are designed to provide effective expansion and penetration for hunting, self-defense, or tactical applications at subsonic velocities. Calibers of bullets and ammunition range from .308 to .458. The bullets are designed around a cylinder of Flex Tip material. As it is in low velocity pistol bullets, the Flex Tip material provides rapid and effective expansion at the slower subsonic velocities down to retained velocities of about 850 to 900 fps. On the surface, this may not sound terribly impressive. But remember the drag on a subsonic bullet is low, and they lose velocity slowly. Retained velocity of 850 to 900 fps is getting out to 300 or 350 yards for a subsonic load. Loads for the .300 Whisper, 7.62x39, and .450 Bushmaster are all designed to run in semiauto firearms.

Conclusion

I hope you have enjoyed reading about the development and application of the Flex Tip polymers as much as I have enjoyed remembering what is now getting to be rather old history. The application of the polymers dubbed Flex Tip by Hornady has led to innovative and high-performance bullets that would not be otherwise possible. Try some on your next hunt or in your personal protection firearms. **H**



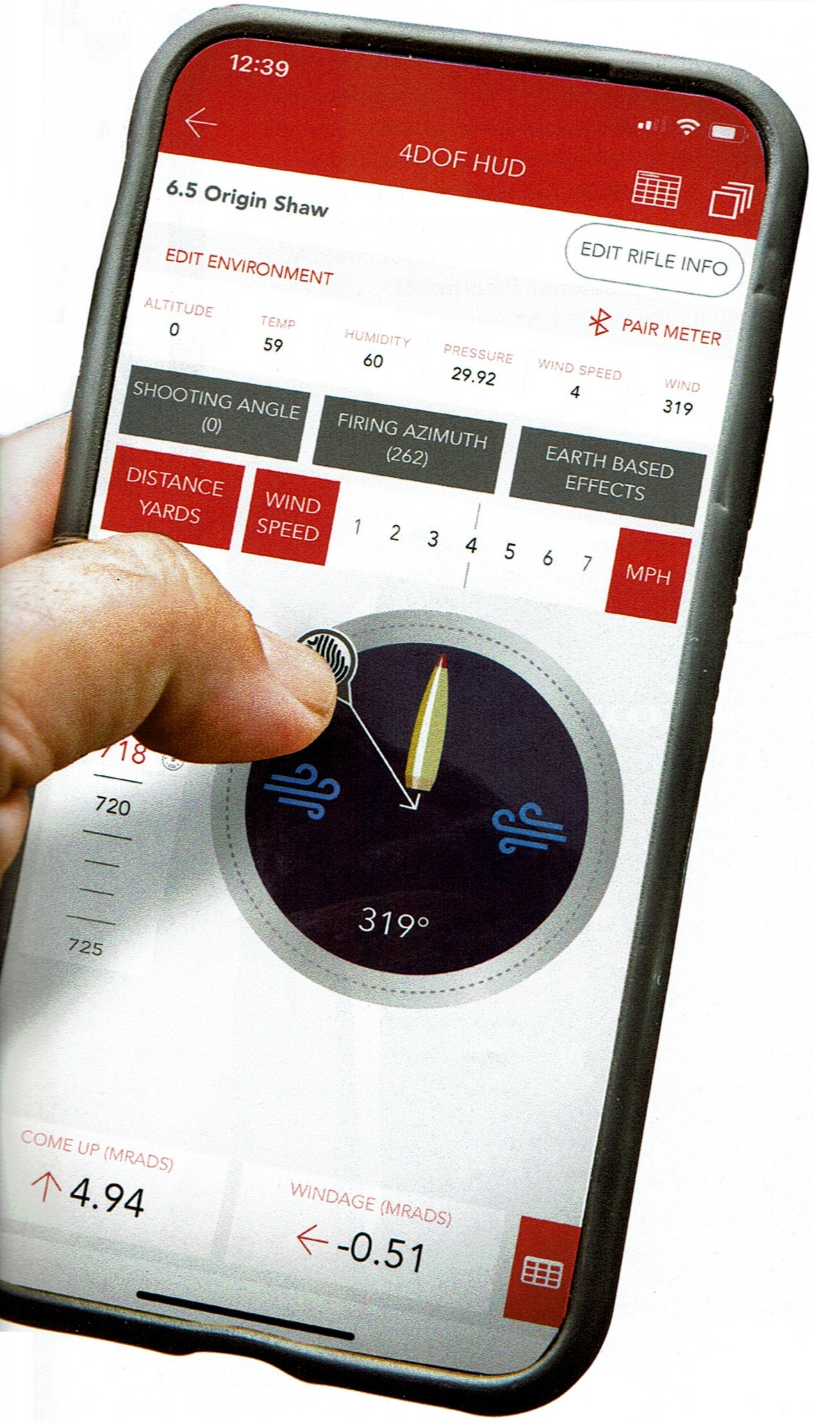
SUB-X bullets, designed around a cylinder of Flex Tip material, rapidly and effectively expand even at subsonic velocities.

Hornady
SUBSONIC
AMMUNITION
20
CARTRIDGES
HORNADY
7.62 X 39

4DOF Ballistic Calculator

By Alfredo Rico

Hornady packs state-of-the-art ballistic solutions into a free app.



6.5 Origin Shaw

ALTITUDE 0
TEMP 59
HUMIDITY 60
PRESSURE 29.92
WIND SPEED 4
WIND 319
SHOOTING ANGLE (0)
FIRING AZIMUTH (262)
COME UP (MRADS) 4.94
WINDAGE (MRADS) -0.51

In 2016, Hornady launched their their app, Hornady Ballistics, which features 4DOF to give long-range shooters a smartphone version of a sophisticated ballistic solver.

However, unlike other calculators, which use three or four bullet data points to estimate trajectories, Hornady pulls in a whopping 437 nuggets of bullet intel. This windfall of data allows shooters to dial in their loads' trajectories for more precise results whether at short or extreme ranges.

The Engine

While Hornady's 4DOF may have "ballistic" in its title, developers actually base the system's calculations on drag coefficient (Cd) instead of ballistic coefficient (BC), which other calculators depend on. Hornady derives a bullet's Cd through the use of Doppler radar to capture flight data – primarily drag – which is then combined with the exact physical modeling of the bullet to calculate trajectory. Bullets of .22 caliber are tracked in the 700- to 1,000-yard range, 6.5 calibers around 1,400 to 1,600 yards, and .30 calibers out to 2,000 yards. This is important because drag is not constant across the entire trajectory of the bullet. As velocity decreases, drag increases. Using Cd gives the calculator the bullet's drag at any given velocity. By comparison, BC-based apps can't account for this variation, since they use one drag number (the bullet's

BC) to make trajectory estimations. A change in BC will affect trajectory.

Another advantage of the 4DOF Ballistic Calculator over BC-based ballistic apps is that Hornady employs four degrees of freedom (4DOF), which represents the independent actions or responses that go into calculating a bullet's position in flight. By design, bullets have six DOF; three are linear (elevation, windage, and range), and three are related to axis rotation (pitch, yaw, and roll.) BC-based ballistic apps use three linear DOF while the 4DOF Ballistic Calculator uses a fourth, what Hornady calls "angle of attack." The angle of attack is the value of pitch and yaw lumped into one factor.

The angle of attack is important because each bullet behaves differently in flight. The 3DOF ballistic apps treat the bullet nose as though it is motionless, but upon launch, the bullet nose has some wobble to it and then settles down. The more the nose moves, the more it affects the bullet's flight. The angle of attack is also needed to correctly account for aerodynamic jump and spin drift.

Bullet data is also much more detailed than BC-based apps. With the 4DOF Ballistic Calculator, the specific bullet you choose has been modeled in detail, including boattail, bearing surface, ogive, and meplat dimensions. It includes the bullet's material density: the lead core, copper jacket, and, if present, the tip. As mentioned earlier, this data is paired with the Doppler radar drag curves that Hornady recorded in the field. The 3DOF ballistic solvers don't know specific details about the bullet you are using but compare the manufacturer's stated BC of the bullet to one of two standard bullet shapes, a G1 or G7. The G1 bullet is a short, flat-based, blunt-nosed bullet shape, and the G7 is a longer bullet with a boattail, ogive, and pointed nose.

When the information from the drag curves, 4DOF data, and bullet modeling is added up, the result is 437 data points that are used to determine trajectory. Having more details gives the Hornady app more precise trajectory calculations.

The App

Another strength of this app is how Hornady designed the interface. Many of the important functions that a shooter would change are a click away in the heads-up display (HUD) instead of buried in multitiered menus. Like many ballistic apps, the calculator includes a bullet library, stored rifle/bullet profiles, Bluetooth connectivity for weather meter input, wind speed and direction inputs, elevation and windage corrections, and a trajectory table. It also has a truing function, which Hornady calls Axial Form Factor. The app includes a 3DOF ballistic calculator, but its 4DOF calculator is what makes this unique.

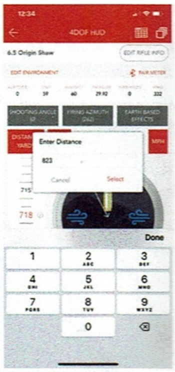
Every bullet in the 4DOF library consists of bullets that are designed for long range. The ever-growing list includes Hornady's ELD Match, ELD-X, A-TIP, and CX bullets as well as Barnes, Berger, Lapua, Nosler, Sierra, and others.

Rifle and bullet setup is straightforward, and due to how large each bullet file is, you can only assign one bullet to a rifle profile. Once you set the profile up, you are taken to the HUD. The top third of the HUD is comprised of settings such as environment, shooting angle, firing azimuth (direction), and environment. Clicking on the Bluetooth logo allows you to download weather data from your weather device. A shortcut to your rifle/bullet information is in the top corner.

The bottom two-thirds of the HUD is dedicated to your correction factors. This is where you input yardage, wind speed, and wind direction to get your come ups and windage correction. All the numbers are large and finger friendly. The yardage, wind speed, and wind direction can be changed by swiping them. To enter yardage using the keyboard, tap on the yardage slider. Tapping the Come Up box brings up a card that allows you to change measuring units such as MOA, MRAD, inches, and yards to meters. At the center of the card is a large red button labeled Come Up Calibration. This opens the Axial Form Factor page where you can true your bullet's trajectory.

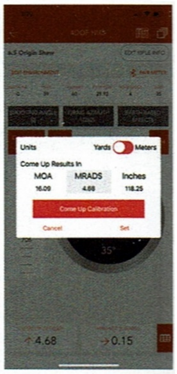
One of the neat features of the app is called Zero Angle. It's an alternative to using Zero Range. With Zero Angle, you zero your rifle normally but add environmental and impact offset information. The app uses this info to calculate the rifle's zero angle. According to Hornady, the benefit to using Zero Angle is that you won't have to re-zero your rifle when you shoot it in different environmental conditions. This includes elevation swings from sea level to 15,000 feet.

If having a powerful computing engine and features wasn't enough, Hornady goes one step further and offers the 4DOF app for free. Sure, there are three paid add-ons, but they are not needed to take advantage of the app. The add-ons are Multiple HUDs, Multiple Range Cards, and Group Analysis. Multiple HUDs allow you to save multiple instances of a HUD. This is useful if you want to pan back and forth between different yardages or wind conditions. Multiple Range Cards are useful for competitive shooters who save information for multiple ranges. The Group Analysis analyzes your shot groups and saves them to your rifle profile. The 4DOF Ballistic Calculator app is available for Android and iOS devices.



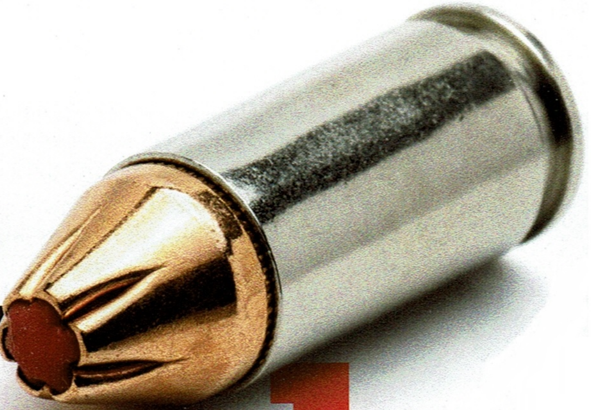
The target distance can be set via a slider or a text input card. To open the card, tap the slider.

Tapping the Come Up box opens a card that allows you to change measurement units and access the Axial Form Factor.



Kimber
Hornady
CRITICAL DUTY
25 ROUNDS
Hornady
25 ROUNDS
CRITICAL DUTY
8468CD

Mission Critical



Whether for defense or duty, Hornady has you covered.

By Richard Nance

Photos by Alfredo Rico & Mark Fingar

When I started writing for gun magazines in 2008, Hornady had just released a new ammunition line that was causing quite a stir within the industry. Critical Defense, as the new round was called, was initially available in .380 ACP, .38 Special, .38 Special +P, and 9mm. The nickel-cased, red elastomer tipped rounds had a distinct look, but it was performance rather than aesthetics that was turning heads toward Critical Defense.

At the heart of Critical Defense is Hornady's patented Flex Tip technology. The Flex Tip or "FTX" bullet uses a pliable elastomer insert to fill the void in the hollowpoint. The FTX bullet was designed to prevent clogging, a common problem with traditional hollowpoints upon impact with heavy clothing. When clogged, a hollowpoint is essentially a full metal jacket (FMJ) bullet. Bullet expansion and overall terminal performance can suffer dramatically. To the defensive handgunner, that means even well-placed rounds might fail to stop the threat.

Since the FTX bullet won't clog upon impact with heavy clothing, it will expand more consistently, thus maximizing the bullet's effect on target. While this is irrelevant when your target is a piece of cardboard, a sheet of paper, or a chunk of steel, bullet expansion is extremely important when your target is a person intent on harming you or a loved one.

FTX technology was the brainchild of Hornady ballistician and *Guns & Ammo* contributor, Dave Emary. First incorporated in their LEVERevolution ammunition line, the elastomer tip enhanced expansion, and the flat nose design improved ballistic coefficients on rounds fired from a lever-action rifle. Critical Defense borrowed these design elements for a defensive handgun round.

As with most unique products, Critical Defense was met with its share of skepticism. It didn't take long, however, to quiet the naysayers. Performance speaks for itself, and Critical Duty performed. It proved to be accurate and to expand well, even after passing through obstacles like heavy clothing, which could wreak havoc on traditional hollowpoints.

Like the red tip, the nickel-plated cases on Critical Defense cartridges aren't merely cosmetic. Nickel is more resistant to corrosion than traditional brass cases, and it's also easier to see should you need to chamber check your pistol in diminished light, for instance. Low flash propellants used in Critical Defense ammunition minimizes muzzle flash and helps preserve night vision when firing.

In a self-defense situation, the ability to deliver hits in rapid succession could make all the difference. Designed for short-barreled concealed-carry guns, Critical Defense produces relatively light recoil, enabling the defender to fire faster, more accurate follow-up shots if needed.

Speaking of accuracy, the best terminal ballistic performance in the world is meaningless if the ammunition you're using isn't accurate enough to consistently hit the target. Having used Critical Defense in numerous handgun tests over the years, I can vouch for its inherent accuracy.

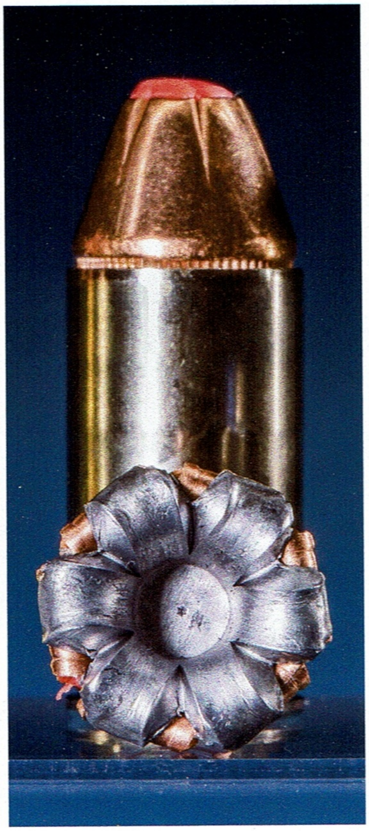
The sustained success of Critical Defense ammunition has spawned more caliber offerings to include rifle cartridges now available in 55- and 73-grain .223 Remington, 110-grain .30 M1 Carbine, 155-grain .308 Winchester, and 45-grain .22 WMR.

For self-defense, Critical Defense is a solid choice, but Hornady wanted to incorporate FTX technology into a 9mm load capable of better penetrating barriers such as auto glass, wallboard, plywood, steel, and ballistic gelatin, which, in addition to denim, constitutes the FBI Protocol for tactical handgun ammunition tests. This was the impetus for Critical Duty, now available in 9mm, 9mm +P, .357 SIG, .357 Mag., .40 S&W, 10mm, and .45 ACP +P.

Designed to perform optimally in full-size handguns like an officer's sidearm, Critical Duty punches through barriers thanks to its FlexLock bullet. Like Critical Defense, Critical Duty features a Flex Tip, but it also includes a mechanical jacket-to-core InterLock band that keeps the bullet from separating from the core. This results in maximum weight retention, consistent expansion, and ideal penetration through all FBI test barriers.

The core of a Critical Duty bullet is made of high-antimony lead, which delivers controlled expansion for optimal terminal ballistic performance. It's also less expensive than comparable bonded bullets. Critical Defense and Critical Duty use cannelure bullets and case crimping to prevent bullet setback during feeding.

Hornady
CRITICAL
DUTY
20 ROUNDS



Consistent expansion is a critical quality for a defense bullet to possess when facing a human threat.

Despite the quantifiable benefits of Critical Duty over standard hollowpoint bullets that have been industry standard in law enforcement for decades, police agencies were slow to adopt this technologically advanced round. But that all changed in 2018 when Hornady's 135-grain Critical Duty load won the FBI 9mm +P Service Ammunition Contract. The FBI reported that this was the most accurate 9mm round they had ever fired. Predictably, when the FBI made the switch to Critical Duty, state and municipal law enforcement agencies followed suit.

At that time, I was a firearms instructor for a mid-sized police department in Northern California. Our issued duty pistol was the .45 ACP-chambered Glock 41. When our police chief stopped me in the hallway and asked if we should switch to 9mm pistols, I answered with an emphatic, "Yes!"

All things equal, a bigger bullet is better than a smaller one, but when it comes to handgun calibers, all things are never equal. There's always a tradeoff. The .45 ACP was once known for its superior terminal ballistic performance. However, thanks to its worldwide popularity, the 9mm has benefited more from technological advancements than any other cartridge.

Today's 9mm has narrowed the gap in terms of ballistic performance as compared to the .45 ACP. It does so while providing a narrower grip that's more comfortable for smaller-handed shooters. The 9mm also exerts less recoil and provides a higher magazine capacity. These are significant advantages, and when you consider that no handgun round, regardless of caliber, is likely to result in an immediate physiological incapacitation, having more rounds in a chambering that's easier to control makes perfect sense.

After extensive research to justify the department-wide transition from .45 ACP to 9mm, I, along with the rest of the firearms instructor cadre, also recommended the department consider switching to a new duty load. After testing and researching, my department, like the FBI, selected Critical Duty. There was an immediate improvement in qualification scores compared to the .45 ACP with traditional hollowpoints.

Improved accuracy from the switch to 9mm and from traditional hollowpoints to Critical Duty is one thing, but how does Critical Duty stack up regarding terminal ballistic performance? After all, if an officer's bullet doesn't stop the bad guy, police and innocent citizens remain in grave danger.

Too little or too much penetration can be detrimental to terminal ballistic performance. To reliably stop a deadly threat, you need the right combination of penetration and expansion. Ideally, the bullet you rely on is "barrier blind." In other words, the bullet will pass through the barrier without negatively affecting its effectiveness on target.

25
Hornady
CRITICAL DEFENSE®
LOADED WITH PATENTED FTX® BULLET
CRITICAL DEFENSE
LOADED WITH PATENTED FTX BULLET

The high-antimony lead core of Critical Duty bullets allows them to expand controllably for optimal ballistic performance.

The FBI Protocol calls for a 9mm bullet to penetrate between 12 and 18 inches through bare gelatin, meant to replicate human tissue. On Hornady's website, a video shows the 135-grain 9mm +P Critical Duty penetrating about 15.5 inches, which is right in the sweet spot. These results are consistent with what I've experienced shooting bare gelatin with Critical Duty. What's even more impressive is how the bullet expands and stays intact when passing through barriers en route to the gelatin block.

Critical Duty is not restricted to law enforcement. But, since it's not optimized for short-barreled concealed-carry handguns, you won't experience a reduction in felt recoil the way you would with Critical Defense. For most armed citizens, Critical Defense is the better choice. But, if you carry a full-sized pistol and want the best barrier penetration and terminal ballistic performance possible, Critical Duty is the clear choice. H

HORNADY
9mm LUGER

Nickel-plated cases resist corrosion and are easier to see when chamber checking your pistol, especially in low light.

Smoke Stacked

From round balls to Bore Driver, Hornady's muzzleloader bullet development has kept pace with advancements in blackpowder rifle technology.

By Brad Fitzpatrick

Hornady
Accurate. Deadly. Dependable.
50% EASIER TO LOAD!
SST-ML HIGH SPEED LOW DRAG
Flex Tip™ technology dramatically improves ballistic coefficient for longer, flatter shots
Proven SST® bullet delivers 200 yard accuracy
New Low Drag™ sabot is 50% easier to load than conventional sabots
The easy-loading alternative that delivers pinpoint accuracy!
25
Muzzleloading
50 CAL
45-250 GR

The company that Joyce Hornady founded 75 years ago will always be synonymous with centerfire rifle and handgun ammunition, but Hornady's continued commitment to muzzleloader hunters cannot be ignored. During their history, Hornady has offered hunters everything from round lead balls to modern, sophisticated hunting bullets like the Bore Driver.

What's most interesting, perhaps, is that the company still offers a full range of muzzleloader hunting bullets for every hunter, including their original round ball. Hornady's muzzleloader offerings read like a history of the brand's muzzleloader bullet development, and several of their original designs from decades past are still available. Hunters simply fell in love with these bullets, and Hornady kept them in the catalog even when newer designs emerged.

Hornady's bullets have evolved alongside modern muzzleloading rifles, and it's fair to say that today's smokepoles, which use pelleted powder, modern triggers, hot 209 primers, and magnified optics, have redrawn the traditional boundaries of muzzleloader performance. But whether you're hunting with a traditional Hawken with iron sights or an ultra-modern scoped muzzleloader, Hornady offers the ideal muzzleloading bullet for you.

MUZZLELOADING
Hornady
BORE DRIVER FTX
LOADS FAST AND EASY
EXTREME ACCURACY
MAXIMUM LETHALITY
PATENTED FLEX-TIP TECHNOLOGY
20 COUNT
FOUR 5-PACK SPEED LOADERS
50 Cal. | 290 gr.
ACCURATE. DEADLY. DEPENDABLE.
BORE DRIVER LD-X
340 gr.
FOUR 3-PACK SPEED LOADERS

Round Balls

Round-ball projectiles for muzzleloaders seem like a very basic bullet design, but any serious traditionalist will tell you that not all are created equal. Hornady's round ball offerings are available from .32 to .58 caliber, and there are several diameters available in each caliber.

If you've fired centerfire guns your entire life, you likely had to read the last sentence twice. Several diameters in each caliber? Well, yes. Traditional muzzleloaders require patches, and finding the right patch/ball/powder combination to provide consistent accuracy takes time. Many hunters who use .50-caliber muzzleloaders will choose either .490- or .495-inch round balls and test them with various patches to determine which combination works best in much the same manner that a reloader works up precision loads. Hornady offers .480-, .490-, and .495-inch round balls, so shooters can tailor their round ball load for maximum accuracy, and that's why the company's projectiles have remained so popular among traditional muzzleloader hunters.

That's not the only reason muzzleloader hunters use Hornady round-ball bullets, though. These swaged lead bullets are very concentric, and bullet weights are consistent. It's not uncommon for round balls to vary by as much as 5 percent in overall weight, which is equal to about eight grains of ball weight in a .50-caliber muzzleloader. That type of inconsistency ruins accuracy, and that's one reason traditional hunters and competitive blackpowder shooters rely on Hornady.

PA Conical

Hornady keeps their finger on the pulse of the muzzleloading community, and in doing so, they understood the need for heavier bullets for long barrels with slow twists. As a result, the PA Conical was born. These .50-caliber bullets feature a conical shape with a round nose profile for stability and so that tools for traditional round-ball bullets will work with them. At 240 grains, these conical bullets offer 35 percent more weight than a traditional .50-caliber round ball. Not surprisingly, they offer exceptional knockdown power.

Another key feature of these bullets is their prelubed, knurled design. This eliminates the need for a patch or sabot, simplifying the loading process. PA Conical bullets are designed for 1:66-inch twist rifle barrels, but reports are that they are very accurate in faster 1:48-inch twist barrels as well. The PA Conical

Hornady
BLACK POWDER
50 CAL
.512"
240 gr PA CONICAL
Qty: 50
#6617

PA Conical bullets provide excellent knockdown power and accuracy out of slow-twist barrels.

When introduced, the conical, pre-lubed Great Plains bullet wrung the utmost accuracy from inline muzzleloaders.

Consistent expansion and maximum energy transfer make SST ML bullets a great choice for hunting at distance.

isn't a modern muzzleloader bullet when compared with the newer Bore Driver, but the PA Conical does provide an excellent solution for certain hunters and shooters, offering a very accurate muzzleloader bullet that hits with authority.

Great Plains

The modern muzzleloader revolution started in earnest when I was young, and inline muzzleloaders firing conical, pre-lubed bullets allowed muzzleloaders to perform at a level not previously imaginable. One of the leading bullets of this era was Hornady's Great Plains bullet, a pre-lubed, 385-grain, pure lead bullet with a hollowpoint design that hit hard. Hornady even made the audacious claim that these bullets would shoot 1-inch groups at 100 yards, which very few factory centerfire rifles would do at the time.

Since Ohio was a slug-gun-only state for deer during my youth, muzzleloaders were exceedingly popular among hunters. After all, .50-caliber muzzleloaders with modern bullets like the Great Plains offered far better accuracy potential than smoothbore slug guns and doled out much less recoil. What's more, the tapered base made the bullet easy to start in barrels, and the cold-formed lead bullet eliminated air pockets for consistent performance. The Great Plains bullet offered a level of performance never before seen in smokepoles and popularized the notion that muzzleloaders could shoot as good as – or better than – centerfire rifles.

Hornady XTP

The XTP is a low-drag muzzleloader bullet with a sabot that offers exceptional performance from both modern and traditional muzzleloading rifles. The copper-jacketed design with skiving at the nose makes the XTP a very consistent performer on big game, and at 240 grains, it offers plenty of knockdown power and superb accuracy. At its introduction, the XTP offered many features not found on other muzzleloading bullets and ushered in a new era of smokepole performance. The signature green sabot eliminated the need to lubricate the bullet and helped produce very consistent performance. The jacket/core design initiated expansion at any reasonable hunting range, and the consistent expansion resulted in exceptional energy transfer. The XTP may be seen as a "bridge" product today, between Hornady's traditional lead projectiles and modern, tipped, saboted-jacket bullets, but that doesn't mean this bullet isn't a performer. With proper loading in a quality muzzleloader, it'll punch 1-inch groups at 100 yards, and it's a great option for big game.

Hornady
XTP
Low Drag Sabot
Accurate
No Lube
Hard Hitting
High Performance
50 Cal. (430) | 240 gr.
20
GREAT PLAINS
Accurate
No Lube
Hard Hitting
High Performance
Hornady
50 CAL 300 GR
SST-ML
Lock-N-Load
Speed Sabot
Accurate
Hard-Hitting
Convenient
Hornady
10

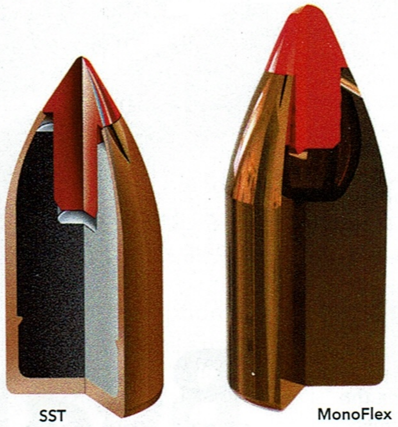
Hornady SST ML

The SST ML is a thoroughly modern muzzleloader bullet with Hornady's signature Flex Tip design. The polymer tip moves rearward on impact and initiates expansion, and the jacketed lead-core bullet design with pre-cut skives results in consistent expansion and maximum energy transfer. The more aerodynamic profile has made the SST ML a favorite bullet of hunters who shoot at 200 yards or more, and it's certainly capable of cleanly harvesting deer and similar-sized game at that distance. One reason for that exceptional accuracy is the SST's low-drag sabot, which is easier to load in the rifle and engages the rifling properly for consistent performance. There's even a Speed Sabot option with a tail that allows you to pre-load pelleted powder.

I've killed two deer with Hornady SST Low Drag bullets, both of which were does. The first doe entered an open grain field during the December firearms season, and by the time the smoke from the burnt powder drifted away into the fading light, she lay piled up where she was standing when I shot. The second doe, which I shot from a range of just over 150 yards, took perhaps two steps before tipping over. This bullet is highly effective and allows you to wring the best accuracy from your muzzleloader. The SST ML is available in both .45- and .50-caliber offerings.

Hornady
MonoFlex ML
Lock-N-Load Speed Sabot
Accurate monolithic solid construction
Flex Tip technology for enhanced terminal performance
Reliable expansion – even at low velocities
High weight retention (95%)
10
50 Cal. (.452) | 250 gr.
Hornady
MonoFlex ML
High Speed/Low Drag Sabot
Accurate monolithic solid construction
Flex Tip technology for enhanced terminal performance
Reliable expansion – even at low velocities
High weight retention (95%)
20
50 Cal. (.452) | 250 gr.

A cousin of the SST, MonoFlex ML bullets feature the same red Flex Tip, skived copper alloy jackets, and red sabots, but they're constructed of copper alloy.


SST
MonoFlex

MonoFlex's monometal construction allows it to retain over 95 percent of its weight, resulting in effective penetration on game.

MonoFlex ML

The MonoFlex ML is a cousin of the SST, and if both are placed side-by-side, most shooters would not be able to tell them apart. Both feature red Flex Tip pointed polymer nose tips, and both have skived copper alloy jackets and red sabots. The difference, though, is on the inside: the MonoFlex is a total copper alloy hunting bullet. As such, it is legal for hunting in areas where lead is banned. The monometal construction also allows these bullets to retain over 95 percent of their original weight for consistent, deep penetration. Like the SST, they're easy to load and are very accurate, making them a viable non-toxic alternative to more traditional muzzleloading projectiles.

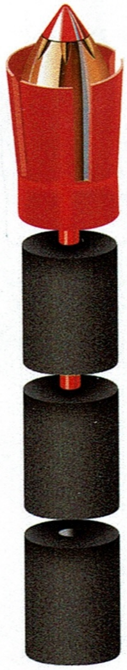
Bore Driver

We've arrived at Hornady's most modern muzzleloader bullet, the Bore Driver, which is a high-tech muzzleloader bullet that's designed for extended-range hunting on large game. Unlike the SST and MonoFlex bullets, Bore Drivers feature a polymer base that seals to the bore and is very easy to load. The base has a skirt that engages the rifle and a center post that extends into the core of the bullet. On firing, the post expands for improved torque engagement. Performance is very consistent with these bullets, which are available in 290- and 340-grain .50-caliber versions. The 290-grain offering comes with a traditional FTX bullet, while the 340-grain version utilizes an ELD-X bullet, the same sleek, gilding metal-jacketed bullet Hornady uses in their long-range centerfire hunting ammunition. Both bullets have polymer tips that initiate expansion even at low velocities, and both feature an InterLock ring that helps retain weight. Bore Driver bullets are capable of extreme accuracy and help push the boundaries of muzzleloader performance – and carry on Hornady's tradition of offering the best, most advanced muzzleloader bullets.

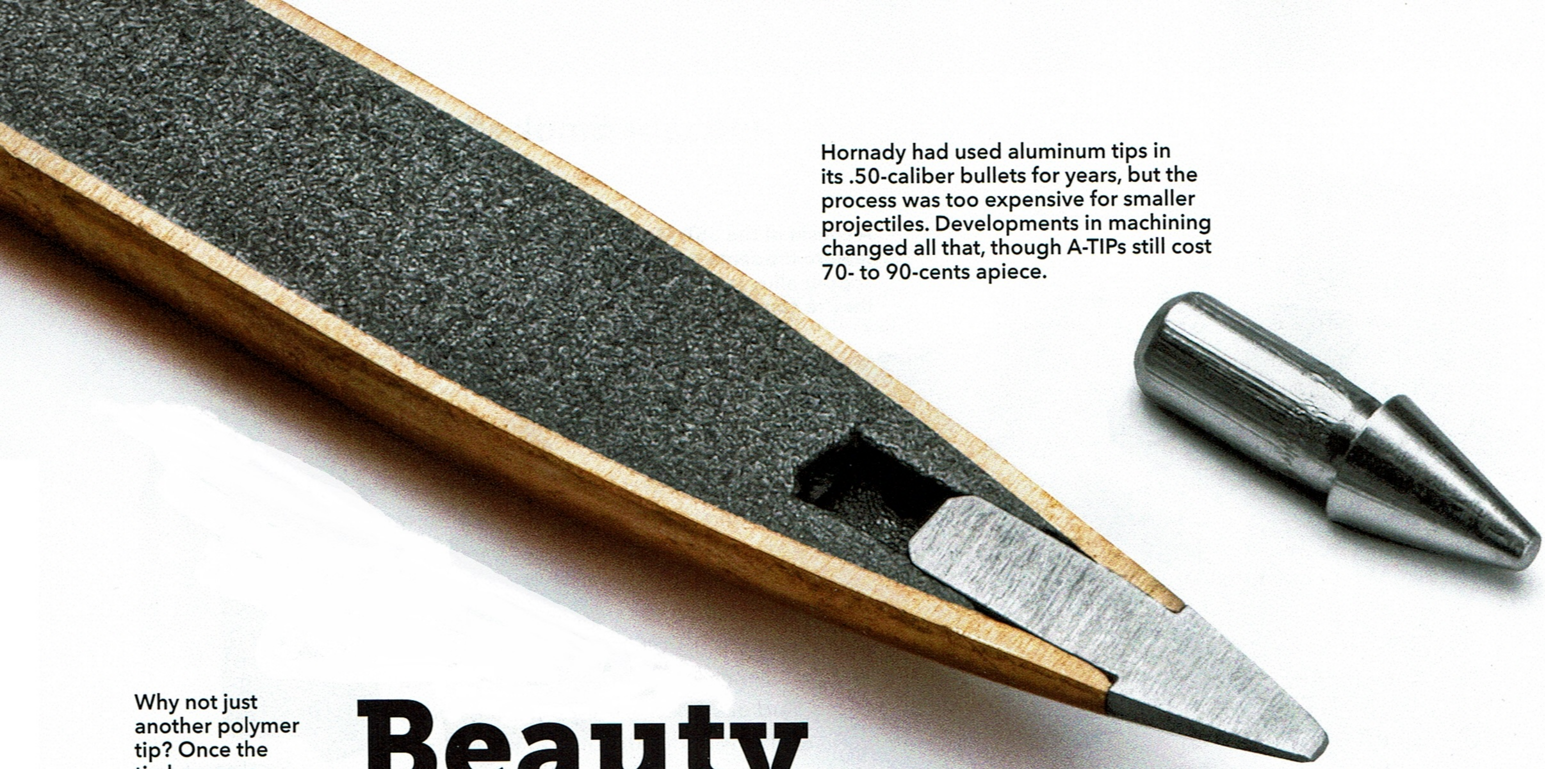
Why a Muzzleloader?

Modern centerfire rifles are capable of exceptional accuracy, so why would anyone choose to hunt with a muzzleloader? For starters, modern muzzleloaders are extraordinarily capable, and depending on the model, within 200 to 400 yards, most muzzleloaders are as deadly as a centerfire rifle. I took a New Mexico bull elk with a .50-caliber muzzleloader with a Trijicon scope at 305 yards, and the bull didn't travel more than 30 yards after the initial hit. Not long ago, a shot like that would have been considered unethical because rifles and bullets simply weren't capable of consistent performance at that distance. Today, however, bullets like the Bore Driver make shots at 300 yards and even farther a real possibility.

Modern muzzleloaders are accurate and reliable, but they still offer just one shot. And, in a way, that's part of their appeal. You must make certain that you're close enough to make that first (and likely last) shot count. And when that shot presents itself, make certain that you're using the right bullet.



The Speed Sabot's tail gives shooters the option to preload pelleted powder.



Hornady had used aluminum tips in its .50-caliber bullets for years, but the process was too expensive for smaller projectiles. Developments in machining changed all that, though A-TIPs still cost 70- to 90-cents apiece.

Beauty Is More Than Skin Deep

By Tom Beckstrand

Long-range shooting is the new frontier of riflery. Hornady promises to make it a lot easier to hit past 1,000 yards.

Why not just another polymer tip? Once the tip becomes long enough, polymer can't take the forces induced during firing. That requires using a tougher material like aluminum that, while light, can stand up to heavy stresses.

No shooting discipline has changed more over the last five years than precision rifle and long-range marksmanship. Ten years ago, a successful 1,000-yard shot took a lot of effort and ability. That same amount of effort and ability today will yield hits at 2,000 yards.

We have the gift of modern machining and computing to thank for this. Rifles and bullets have never been made to tighter tolerances, and supercomputers in the form of a cellphone handle incredibly complicated ballistic calculations. Modern instrumentation allows manufacturers to record product performance previously inaccessible without having access to the federal budget and federal testing facilities.

The most groundbreaking advancement in long-range shooting for 2019 is Hornady's A-TIP bullet. While it may look like a regular bullet with an aluminum nose, there's a whole lot of new science behind it that offers any shooter advanced performance that was previously impossible.

Return On Investment

A few years back, Hornady dug deep and pulled out enough money to buy an advanced Doppler radar system. This allowed engineers to record a bullet's flight from the muzzle to distances greater than 2,000 yards. The radar system does this by "pinging" the bullet to record its location every few inches for the entire flight. This degree of resolution is impossible without Doppler.

However, possessing the radar system was only the beginning. The data the system generated from each bullet fired allowed Hornady to create drag curves for their bullets and most of their competitor's bullets. These drag curves are commercially available in a ballistic calculator called 4DOF (Four Degrees of Freedom), the best ballistic calculator on the market and the one I personally use. It is free, so everyone else should be using it, too.

The team of ballisticians at Hornady have spent years firing countless bullets across their radar system, and they've learned a few things in the process. The most important concept they've discovered is the relationship that exists between a bullet's center of gravity (COG) and center of pressure (COP).

A bullet's COG is the point where a bullet is perfectly balanced and where it would stay if placed on the head of a pin. This point is usually found in the rear half of the bullet because that's where most of the weight is located.

When the bullet leaves the muzzle and pushes through the air, all the wind resistance converges on the COP. The COP is found towards the front of the bullet and is determined by the shape of the bullet's nose. The problem is the bullet wants to balance at the COG, but all external forces meet at the COP. The distance between these two points creates a lever that can make it difficult to stabilize the bullet.

The answer to that stabilization problem is to spin the bullet. Historically, the longer the bullet (and the higher the ballistic coefficient), the greater the distance between those two points and the faster it must spin to stay stable.

Hornady's Doppler radar system allowed its engineers to watch bullet stability closely and record what happened when the distance between the COG and COP changed. This high degree of resolution during the bullet's flight allowed them to begin experimenting with alternate materials and methods of manufacture to get the ideal COG and COP relationship for the best performance. From this research, the A-TIP was born.

More Than A Pretty Face

Hornady has used a polymer tip on match bullets for a long time because they are very uniform and help give the bullets high ballistic coefficient (BC). What Hornady learned during the development of the A-TIP was that bullets also benefit from longer tips because they move weight out of the nose. Making the bullet longer and pointier without making the nose heavier became a priority.

Making longer tips out of polymer wasn't a viable solution. Polymer works very well when the tip is kept short but lacks the shear strength necessary to stay in one piece when the tip gets longer.

Hornady has been putting aluminum noses on 750-grain .50-caliber bullets for a long time, but the process has been time-consuming and expensive. When the experts looked closely at using aluminum on more mainstream projectiles, they discovered that advances in modern machining made it possible to use the material on a larger scale while keeping costs much lower than previously possible. Hornady quickly moved forward with the aluminum tips.

Using the aluminum tip gave Hornady the option to make a bullet longer (giving it a higher BC) while using the aluminum's light weight to manipulate the bullet's COG. The aluminum tip extends below the jacket and is used in strategic locations to achieve the ideal relationship between COG and COP.

Hornady learned that when the proper relationship between COG and COP exists, the bullet "goes to sleep" very quickly once it leaves the muzzle. When a cartridge fires, the bullet very rapidly goes from zero to a couple thousand feet per second (fps) while also moving from zero to a couple hundred thousand revolutions per minute (RPM). Combine that sudden acceleration with a super-heated cloud of gas that envelops the bullet as it leaves the muzzle (causing it to go subsonic in the cloud then transitioning to supersonic when it hits clean air), and it takes the bullet a moment to stabilize once in flight.

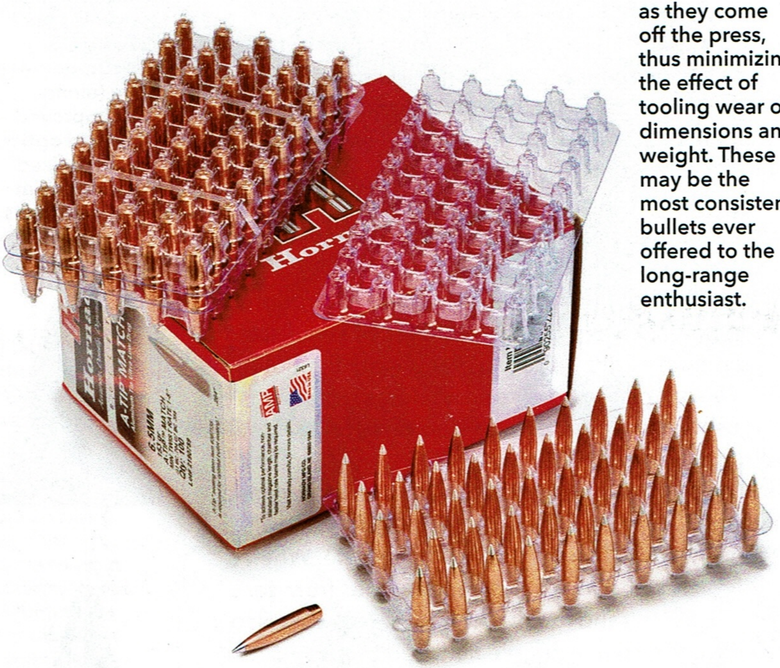
Many of today's most popular bullets also have an aggressive boattail, and this makes it easier for the bullet to get pushed off-center by the gas behind it. All these influences often cause the bullet to wobble when it first leaves the muzzle until everything settles down. The "settling down" process is usually referred to as "going to sleep."

No bullet goes to sleep faster than Hornady's A-TIP, and the aluminum tip is the reason why. Using a long aluminum tip that extends underneath the jacket puts the COG in a place where the bullet wants to stabilize quickly.

While it would be easy to think that the effects and benefits of rapid stabilization don't occur until the bullet is several hundred yards downrange, the reality is that the advantages are visible at distances as short as 100 yards. Loading up some of the 153-grain A-TIPs in 6.5 Creedmoor with a charge of H4350 behind the bullet showed me one unique characteristic that benefits just about every shooter.

No matter the weight of the powder charge, the group sizes for the A-TIPs were eerily similar. I used an Accuracy International rifle with a Bartlein barrel

The A-TIP is a very long boattail with a distinctive aluminum tip. It's tailor-made for cartridges like the 6.5 Creedmoor that have (along with improved rifles and optics) revolutionized competition at extreme ranges.



Bullets are packaged in sequential order as they come off the press, thus minimizing the effect of tooling wear on dimensions and weight. These may be the most consistent bullets ever offered to the long-range enthusiast.

If you're looking for the ultimate in long-range accuracy, Hornady's A-TIP offers a design specifically intended for shots at 1,000 yards and beyond. The price is eye-watering, but the results are well worth the toll.

during testing, and all groups were uniformly small. Load selection came down to the one that had the best numbers on the chronograph.

The load I settled on was 41.4 grains of H4350 with a muzzle velocity of 2,759 fps. The group looked great, and it had an extreme spread (ES) of 19 fps with a standard deviation (SD) of 6. I stop worrying about load development when the SD hits the single digits.

The consistency of the small group sizes at 100 yards makes load development easy, but that same consistency yields huge dividends when the range to the target increases. When a bullet leaves the muzzle and "struggles" to stabilize, it develops a unique flight path compared to each bullet that follows it. They will not all "struggle" in the exact same manner, so small differences at the muzzle equate to huge variation at several hundred yards. The problem is exacerbated when the distance to the target gets past 1,000 yards.

While the A-TIP bullets show a small visible improvement in accuracy and consistency from one group to the next at 100 yards, the performance increase at several hundred yards is much more visible. Small errors compound with distance, so the rapid rate at which the A-TIP stabilizes immediately upon leaving the muzzle puts it in a class of its own in terms of long-range performance.

Time and Money

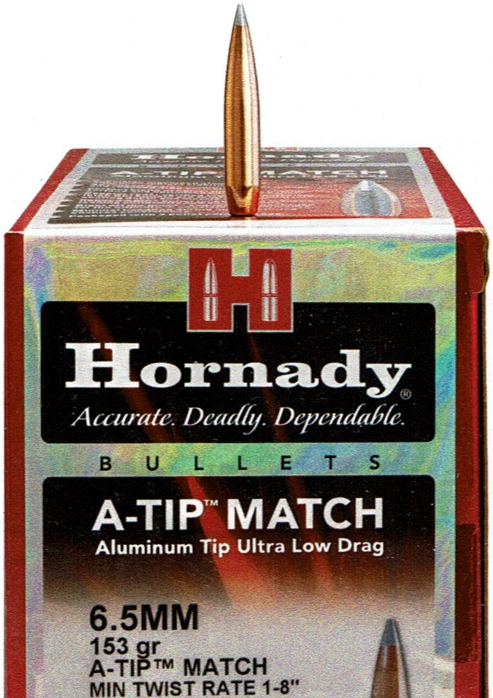
While these Hornady bullets have a ton of new technology built into them, they are a lot more expensive than Hornady's other offerings. A-TIP bullets go for 70- to 90-cents each, so I wouldn't use them for plinking ammo. However, they would be and are my first choice for any serious long-range shooting.

Where A-TIP bullets save the shooter a bunch of money is in load development. As I saw during my testing, load development with A-TIPs is a much mor abbreviated process than normal. The savings come in the form of fewer bullets fired and in time.

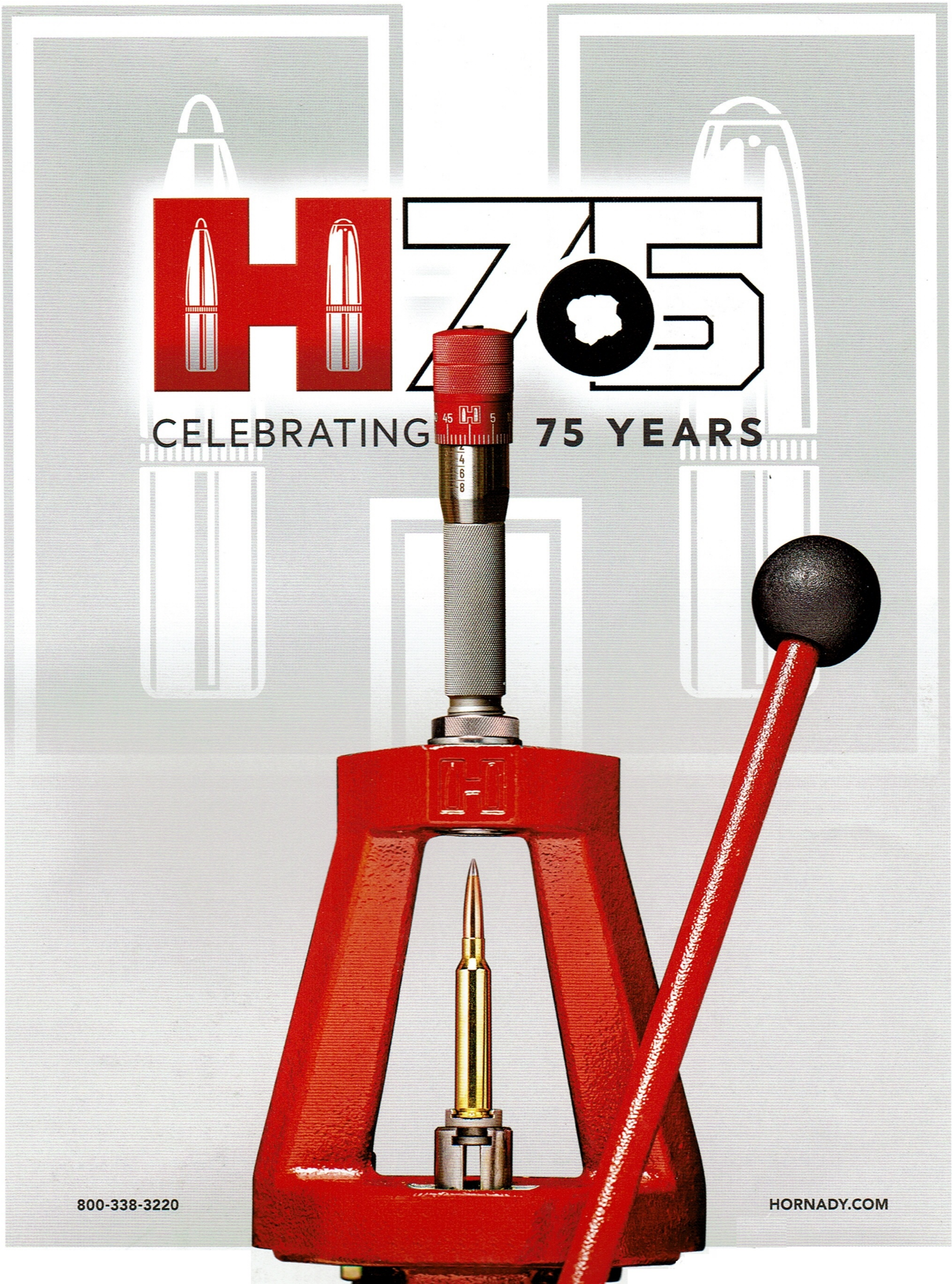
There's also the time saved from not having to twe the load as the throat erodes. As the rifling erodes in the bore, most bullets have a higher probability o becoming crooked inside the bore before engaging the rifling. The A-TIP's dampening helps as much in the bore as out, so it should prove more resistant to throat wear.

A-TIPs come in sequential packages, so there is no variation in tooling wear from one bullet to the next. If someone orders 100 bullets, they all came off the assembly line in that order. There is no way to get more consistently made bullets than this type of packaging. I imagine it's a logistical nightmare for Hornady, but it gives the customer another advanta in ensuring their bullets are as consistent as possible

There are very few pieces of equipment that can yield an immediate increase in performance. The A-TIPs meet this description, even if the shooter is already using a very high-quality bullet. No other bullet stabilizes faster upon exiting the muzzle, and no other bullet is made more consistently. Switching to A-TIP bullets will yield higher scores in matches a more hits in the field. **H**



PRECISION **RELOADS** EACH AND EVERY TIME



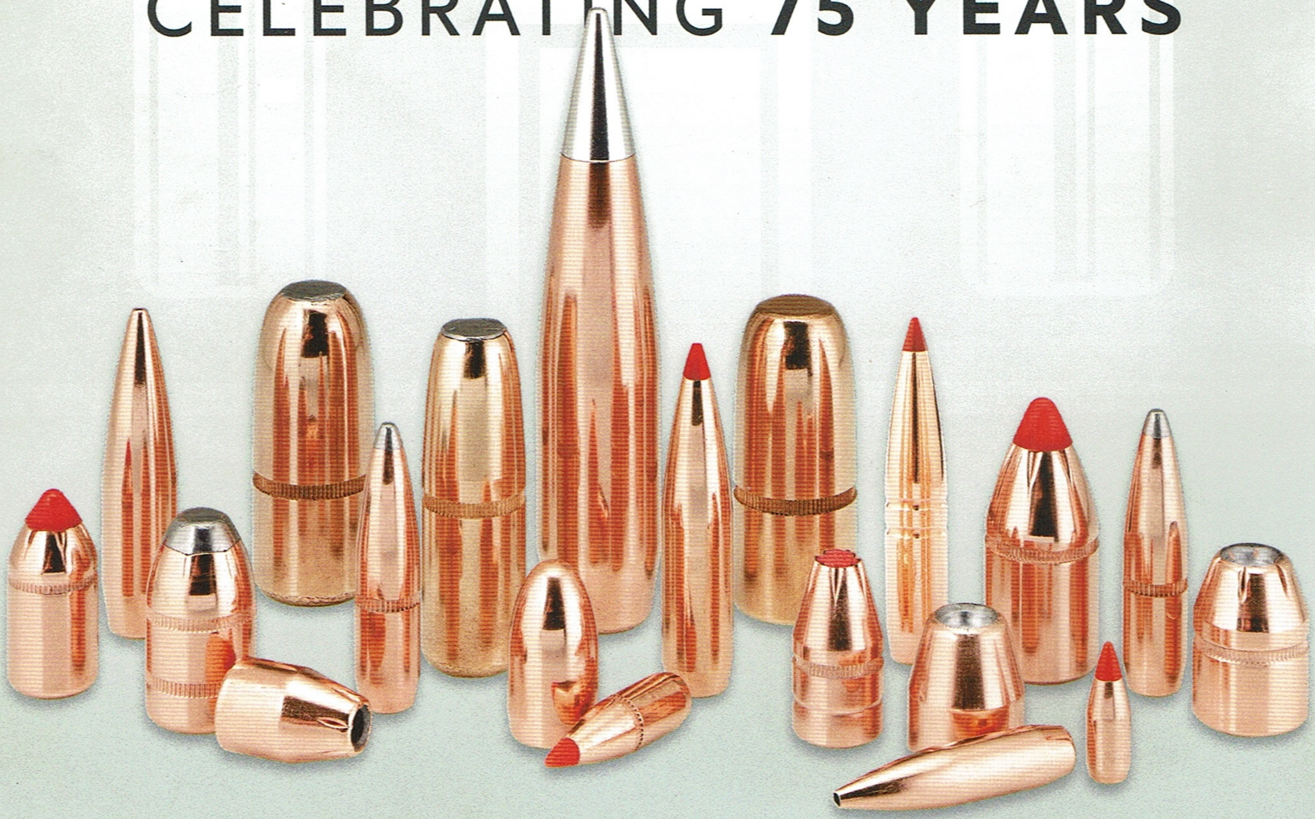
CELEBRATING 75 YEARS

800-338-3220

IT ALL STARTED WITH A **BULLET**

H75

CELEBRATING **75 YEARS**



Accurate. Deadly. Dependable.®